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NATIONAL DAM SAFETY PROGRAM. MONGAUP FALLS DAM (INVENTORY NUMBE--ETC(U)
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Delaware River Basin, Sullivan County, New York
Inventory No. 321

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Sullivan County
Forestburg

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

The examination of documents and visual inspection of Mongaup Falls Dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to life or property. The dam, however, has a number of problem areas, which if not remedied, have the potential for developing into hazardous conditions. These problem areas are as follows:

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- (1) The structural stability analysis indicates that the factors of safety for the spillway section of the dam during the Probable Maximum Flood (PMF) and $\frac{1}{2}$ PMF events are unacceptable.
- (2) Seepage on the east wall of the gate house above the penstock, and deterioration of concrete at the north spillway buttress, the gate house, the intake walls of the gate house, and the non-overflow section. Seepage at the north and south ends of the spillway through the bedrock abutments and the buttress walls.
- (3) Jointing of the bedrock in the outlet and downstream channels which may extend beneath the dam.

Investigations are required in these areas to ascertain the type and extent of remedial measures required. These investigations should include, but not be limited to, the following: Installation and monitoring of weirs or other devices to measure seepage, concrete coring of the gate house structure, and subsurface exploration of the outlet channel and foundation of the spillway with drill holes to determine the extent of bedrock jointing. Drill holes may also serve to determine the uplift forces beneath the dam to aid in stability investigations. The investigations should be initiated within 6 months from notification and remedial action completed within the following year.

The following remedial actions should be completed within this construction season:

- (4) Trim the vegetative growth noted on the earth embankment portion up to and including the vegetation noted near the south spillway buttress.
- (5) Backfill the depressions noted on the upstream side of the earth embankment in the original grade.
- (6) Initiate a program of periodic inspections and maintenance of the dam and appurtenances. Document this information and develop an operations manual.

The discharge capacity of the spillway is inadequate for all floods in excess of 79% of the PMF (PMF = 38,000 CFS), without overtopping of the non-overflow portions of the dam. The maximum reservoir level during the PMF will be 2 feet over the top of dam and during the $\frac{1}{2}$ PMF will be 3 feet below the top of dam.

DELAWARE RIVER BASIN

MONGAUP FALLS DAM

SULLIVAN COUNTY, NEW YORK

INVENTORY NO. N.Y. 321

**PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM**



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NEW YORK DISTRICT CORPS OF ENGINEERS

JULY , 1979

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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DELAWARE RIVER BASIN
MONGAUP FALLS DAM
NY 321
PHASE I INSPECTION REPORT

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PHASE 1 REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Mongaup Falls Dam (I.D. No. NY 321)
State Located: New York
County Located: Sullivan
Stream: Mongaup River (tributary of Delaware River)
Dates of Inspection: November 8, 1978 and April 20, 1979

ASSESSMENT

The examination of documents and visual inspection of Mongaup Falls Dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to life or property. The dam, however, has a number of problem areas, which if not remedied, have the potential for developing into hazardous conditions. These problem areas are as follows:

- (1) The structural stability analysis indicates that the factors of safety for the spillway section of the dam during the Probable Maximum Flood (PMF) and $\frac{1}{2}$ PMF events are unacceptable.
- (2) Seepage on the east wall of the gate house above the penstock, and deterioration of concrete at the north spillway buttress, the gate house, the intake walls of the gate house, and the non-overflow section. Seepage at the north and south ends of the spillway through the bedrock abutments and the buttress walls.
- (3) Jointing of the bedrock in the outlet and downstream channels which may extend beneath the dam.

Investigations are required in these areas to ascertain the type and extent of remedial measures required. These investigations should include, but not be limited to, the following: Installation and monitoring of weirs or other devices to measure seepage, concrete coring of the gate house structure, and subsurface exploration of the outlet channel and foundation of the spillway with drill holes to determine the extent of bedrock jointing. Drill holes may also serve to determine the uplift forces beneath the dam to aid in stability investigations. The investigations should be initiated within 6 months from notification and remedial action completed within the following year.

The following remedial actions should be completed within this construction season:

- (4) Trim the vegetative growth noted on the earth embankment portion up to and including the vegetation noted near the south spillway buttress.

- (5) Backfill the depressions noted on the upstream side of the earth embankment in the original grade.
- (6) Initiate a program of periodic inspections and maintenance of the dam and appurtenances. Document this information and develop an operations manual.

The discharge capacity of the spillway is inadequate for all floods in excess of 79% of the PMF (PMF = 38,000 CFS), without overtopping of the non-overflow portions of the dam. The maximum reservoir level during the PMF will be 2 feet over the top of dam and during the $\frac{1}{2}$ PMF will be 3 feet below the top of dam.

George Koch

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New York District Engineer

Approved By:

Date:

24 September 79



Overview of Mongaup Falls Dam
Photo #1



Overview of Spillway
Photo #2

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
MONGAUP FALLS DAM, I.D. NO. NY 321
DEC #148D-130
DELAWARE RIVER BASIN
SULLIVAN COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I Inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection

Evaluation of the existing conditions of the subject dam to identify deficiencies and hazardous conditions, determine if they constitute hazards to life and property and recommend remedial measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. Description of the Dam and Appurtenant Structures

Mongaup Falls Dam consists of a 155 foot long concrete ogee spillway, buttresses at each end of the spillway, a concrete retaining section north of the spillway, and a concrete non-overflow section keyed into bedrock at the south abutment. The maximum height of the dam is 60 feet. A low earth embankment approximately 200 feet long serves as a closure dike and is located about 150 feet southwest of the spillway. The concrete portions of the dam are founded on and keyed into bedrock.

Flashboards 4.8 feet in height are used to augment the storage capacity of the reservoir. A gate house, located at the north abutment of the spillway, controls the flow to the 8-foot diameter wood stave penstock. A vertical slide gate controls the flow to the penstock. The 2800-foot long penstock provides flow to the generating station east of the dam. No reservoir drain was constructed.

b. Location

The Mongaup Falls Dam is located on the Mongaup River, a tributary of the Delaware River, approximately 10 miles southwest of the City of Monticello in Sullivan County.

c. Size Classification

The dam is 60 feet high and stores 1607 acre-feet of water. The dam is classified as "intermediate" in size (40 to 100 feet in height).

d. Hazard Classification

The dam is classified as high hazard, because of its location above the Village of Mongaup (8 miles) and the presence of one other high hazard dam below it.

e. Ownership

The dam is owned and operated by Orange and Rockland Utilities, Inc., 1 Blue Hill Plaza, Pearl River, New York 10965, Tel: (914) 627-2410 or (914) 343-0621.

f. Purpose of the Dam

The dam provides storage for power development.

g. Design and Construction History

The dam was designed by R. R. Livingston Engineers, 2 Rector Street, New York, New York in 1922. The dam was constructed in 1923. No other engineering information pertaining to construction history was available.

h. Normal Operating Procedures

Water stored in the reservoir is used for the generation of electricity by the turbines housed in the power plant approximately 2800 feet below the dam. Water from the reservoir passes through a screen to the intake chamber, located in the gate house near the north spillway abutment, then to an 8-foot diameter wood stave penstock, through a surge tank, and then to the power house. Flow to the turbines is distributed by hydraulically operated wicket gates. Flow not used in the generation of electricity is allowed to spill over the flashboards.

1.3

PERTINENT DATA

a.	<u>Drainage Area</u> (sq. mi.)	160
	Height of dam (feet)	60
b.	<u>Discharge at Dam Site</u> (cfs)	
	Maximum known Flood	12,100
	Spillway at Design Pool (El. 942.0)	21,500
	Spillway at Maximum Pool (El. 945)	30,200
	Maximum Capacity of Reservoir drains	None
	Total Discharge, Max. Pool	30,200
	Average Daily Discharge	Unknown
c.	<u>Elevation</u> (ft. above MSL-Datum)	
	Top of Dam	945.0
	Design Pool	942.0
	Spillway Crest	930.0
	Tailrace Channel	890.0
d.	<u>Reservoir</u>	
	Length of maximum Pool, miles	2.35
	Length of Shoreline (Spillway Crest) miles	4.88
	Surface area (Spillway Crest) acres	140.0

- e. Storage, (Acre-feet)
 Spillway Crest 1,200
 Maximum Design Pool 3,000
 Top of Dam 3,500
- f. Dam
 Type: Earth embankment with concrete core wall
 Length (ft.) 218
 Upstream slope -
 Downstream slope 31
 Impervious Core: Concrete core wall
 Crest elevation, ft. 945
 Crest Width, ft. 12
 Grout curtain None
- g. Spillway
 Type: Concrete Ogee
 Length, ft. 155.0
 Crest Elevation MSL 930.0
 Upstream Channel: Not Visible
 Downstream Channel: Rock
- h. Regulating Outlet
 One 8' diameter wood stave pipe
 (Penstock)
- i. Reservoir Drain
 None

SECTION 2: ENGINEERING DATA

2.1 DESIGN

a. Geology

The Mongaup Falls Dam is located in the "Appalachian Uplands" physiographic province of New York State. This province (northern extreme of the Appalachian Plateau) was formed by dissection of the uplifted but flat lying sandstones and shales of the middle and upper Devonian Catskill Delta. Relief is high to moderate. Maximum dissection occurs in the Catskill Mountain area, where only the mountain peaks approximate the original plateau surface. Drainage is generally south or southwest toward the Delaware River system.

b. Subsurface Investigations

The "General Soil Map of New York State" prepared by Cornell University Agriculture Experiment Station indicates that the surficial soils are Lordstown and Oquaga of glacial till origin. These soils have good internal drainage characteristics. Boulders are common and depth to bedrock is variable. Bedrock was observed outcropping in the spillway channel and at the abutments of the spillway.

c. Dam and Appurtenant Structures

The dam was designed by R. R. Livingston Engineers, 2 Rector Street, New York, New York in 1922. All drawings which are available have been included in Appendix G. The design of the dam includes a buttressed concrete ogee spillway, abutted by 2 concrete non-overflow sections at either end of the spillway. A low closure embankment is located southwest of the dam. All concrete sections are founded on and keyed into bedrock.

2.2 CONSTRUCTION RECORDS

No information regarding the construction of the dam was available other than the year of completion, that being 1923.

2.3 OPERATION RECORD

All information concerning operation and maintenance of the dam is on file with the maintenance staff.

2.4 EVALUATION OF DATA

Some of the data presented in this report has been made available by representatives of Orange and Rockland Utilities, Inc. This information has been invaluable in the preparation of this report. All information gathered appears to be adequate and reliable for Phase 1 Inspection purposes.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspection of Mongaup Falls Dam and the surrounding watershed was conducted on November 8, 1978 and April 20, 1979. The weather was clear and the temperature ranged in the fifties. The reservoir level at the time of inspection was at elevation 930.5 or 0.5 feet above the crest of the spillway due to the presence of flashboards 4.8 feet in height.

b. Earth Closure Embankment

The earth embankment south of the spillway was in good condition. No evidence of seepage or misalignment was observed. Three depressions were noted on the upstream side of the embankment. (See photos #19, 20, & 21) The cause of these depressions is unknown. The distance from the earth embankment and the height above normal reservoir levels warrent only filling of these depressions. The earth embankment was heavily vegetated.

c. Spillway

The spillway was treated with gunite in 1975-76, thus masking any detailed inspection of the concrete. Numerous small face drains were installed in the gunite to avoid pressure build up at the concrete-gunite interface. No seepage was apparent from these drains. Some moss and debris were observed. Calcification was evident particularly along the horizontal gunite joints. (See photo #4)

Seepage was observed flowing from a 6-inch drain pipe protruding from the north spillway buttress. This flow was estimated to be 25 gpm. (See photos #7 & 8) This flow is believed to be caused by seepage from the rock outcrop and gate house at the north abutment of the spillway. (See photo #16) The remaining pipes were not flowing.

Seepage was also observed at the south spillway buttress and at the rock outcrop behind the buttress. (See photos #5 & 10) Flow is estimated to be in excess of 15 gpm.

The spillway is founded on and keyed into bedrock. The outlet and downstream channel are also bedrock controlled. The bedrock at the toe of the spillway was rock-bolted to insure the stability of the spillway. A rock bolt is evident in photo #8, right foreground.

d. Gate House and Non-Overflow Section

Concrete surfaces are deteriorated particularly at the north buttress, the gate house, the intake wingwalls, and the non-overflow section. (See photos #7, 11, 12, & 16) While deterioration was extensive, no evidence of settlement, movement, or misalignment was noted. Seepage was observed above the penstock emanating from the east wall of the gate house. This seepage is an indication of the concrete deterioration of the gate house wall. (See photo #16) Extensive vegetation was evident south of the south spillway buttress.

e. Regulating Outlets

An 8-foot diameter wood stave penstock provides the only outlet from the reservoir. This penstock and the vertical slide gate located in the gate tower appeared to be in good condition. (See photos #1,13,14,15, & 18) The penstock terminates at the generating station approximately 2800 feet east of the dam.

f. Downstream Channel

The downstream channel is bedrock formed. The bedrock has extensive joints, both vertical and horizontal. (See photos #2,6,8 & 17) This jointing was of sufficient magnitude that the owner conducted a program of rock bolting to insure the sliding stability of the dam. The consulting firm of Ralph Smith initiated this action. In addition, 400 cubic yards of concrete was placed at the base of the spillway and gunite placed over the entire spillway (1975-76).

g. Reservoir

There are no visible signs of instability or sedimentation problems within the reservoir area.

3.2

EVALUATION

Three significant problem areas were evident during the inspections. These areas require further engineering investigation to determine the need and type of corrective action necessary to insure the stability of the dam and appurtenances.

1. Seepage evident above the penstock on the east wall of the gate house and deterioration of concrete at the north spillway buttress, the gate house, the intake wingwalls of the gate house, and the non-overflow section is significant.
2. Seepage at the north and south abutments of the spillway necessitate installation of weirs, measurement of flows, and analysis of seepage forces.
3. Jointing of the bedrock in the outlet and downstream channels may extend beneath the dam. A boring program may be required to determine the extent of joints beneath the dam.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

The Mongaup Falls Dam is a power generating dam for Orange and Rockland Utilities, Inc. An 8-foot diameter penstock carries water from the reservoir to the power plant located approximately 2800 feet east of the dam. An electrically operated remote controlled vertical slide gate located in the gate house north of the spillway controls the flow through the penstock. The penstock is connected to a surge tank near the power plant. In addition, flow at the entrance to the generators can be controlled by hydraulically operated wicket gates.

All valves are remote controlled by the systems operator located on Dolson Avenue, Middletown, New York.

4.2 MAINTENANCE OF DAM

The operating and maintenance records for the facility are on file with the maintenance staff. Maintenance of the dam is inadequate as noted in "Section 3: Visual Inspection".

4.3 MAINTENANCE OF OPERATING FACILITIES

Maintenance of generating equipment and associated valves, conduits, etc., appears to be adequate. All valves are reported operational. No operations manual is on file. A record of maintenance operations is on file with the maintenance staff.

4.4 WARNING SYSTEM IN EFFECT

An excellent warning system has been developed by the owner, in accordance with Federal Energy Regulating Commission standards. This system was recently updated (December 7, 1978) and is included in Appendix G.

4.5 EVALUATION

Certain remedial measures are required to provide the proper maintenance. Deterioration of concrete surfaces, vegetation removal, and backfilling of depressions near the earth embankment are areas which require maintenance.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE AREA CHARACTERISTICS

The Mongaup Falls Dam is located on the Mongaup River, a tributary of the Delaware River. The drainage area at the dam is 160 square miles. The topography is characterized by steep slopes interspersed by swamps, ponds, and lakes.

5.2 ANALYSIS CRITERIA

Information on the Standard Project Flood (SPF) for the Mongaup Falls Dam and its watershed was obtained from the "Upper Delaware River Basin Hydrologic Flood Routing Model" prepared in 1976 by Water Resources Engineers, Inc. for the New York District of the U.S. Army Corps of Engineers. The rainfall runoff mathematical model HEC-1 developed by the U.S. Army Corps of Engineers was used to reconstitute major floods and to simulate SPF considered in the study. SPF is considered approximately one-half of Probable Maximum Flood (PMF).

The Mongaup Falls Dam watershed is composed of sub-basins 49, 50, and northern part of sub-basin 51 of the Delaware River Basin. The inflow was routed through the reservoir, and the peak outflow was 19,000 cfs due to SPF.

5.3 SPILLWAY CAPACITY

The ungated ogee spillway is 155 feet long, and the maximum head possible between the crest of the spillway and the top of the dam is 15 feet. The crest of the spillway is topped by 4.8-foot high flashboards designed to fail at 2 feet of head over the top of flashboards.

The capacity of the spillway at maximum high water level (EL. 945.0) is 30200 cfs.

5.4 RESERVOIR CAPACITY

The reservoir capacity is given below:

	<u>Elevation (feet)</u>	<u>Capacity (acre-feet)</u>
Crest of spillway	930.0	1,200
Top of flashboards	934.8	1,650
Design High Water	942.0	3,000
Top of dam	945.0	3,500

The storage capacity curve is shown in Appendix C. The curve indicates a surcharge storage of 2300 acre-feet which is equivalent to a runoff depth of 0.27 inches of runoff over the drainage area.

5.5 FLOODS OF RECORD

Maximum flood recorded since completion of the dam is as follows:

<u>DATE</u>	<u>DISCHARGE</u>
August 19, 1955	12,000 cfs

5.6

OVERTOPPING POTENTIAL

The capacity of the spillway is 30,200 cfs compared to a SPF of 19,000 cfs. Hence, the spillway can pass 159 percent of the SPF. However, the PMF of 38,000 cfs will overtop the dam by 1.5 feet.

5.7

EVALUATION

The spillway is adequate to pass $\frac{1}{2}$ PMF (SPF), but inadequate to pass PMF. The maximum capacity of the spillway is adequate to discharge 79% of the PMF.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

The following conditions were observed, which indicate the potential for the development of hazardous conditions although they do not indicate an immediate hazard to human life or property:

1. Seepage was evident on the east wall of the gate house above the penstock, and considerable deterioration of concrete was noted at the north spillway buttress, the gate house, the intake wingwalls of the gate house, and the non-overflow section.
2. Considerable seepage was apparent from the exposed bedrock and through drains in the buttresses at the north and south ends of the spillway.
3. Jointing of the bedrock in the outlet and downstream channels is extensive. These joints may have progressed beneath the dam.

b. Design and Construction Data

No design computations or construction information regarding the structural stability of the dam are available.

c. Operating Records

No operational problems were reported, which would influence the stability of the structure.

d. Post-Construction Changes

Ralph Smith Consulting Engineers initiated a program of rock bolting at the toe of the spillway to insure the integrity of the bedrock foundation. In addition, 400 cubic yards of concrete was placed at the toe and the spillway was gunited (1975-76).

6.2 STRUCTURAL STABILITY ANALYSIS

A structural stability analysis was conducted on Mongaup Falls Dam for the spillway section and the non-overflow section. The information and analysis are included in Appendix F. The results of this analysis are as follows:

<u>Case</u>	<u>Description of Loading Conditions</u>
1	Normal Loading, full uplift, 3' tailwater, reservoir at 933.0;
2	Ice Loading, full uplift, 3' tailwater, reservoir at 928.0;
3	$\frac{1}{2}$ Probable Maximum Flood (PMF), full uplift, 3' tailwater, reservoir at 942.0 (12 feet above spillway crest or 3 feet below top of non-overflow section w/no tailwater);

<u>Case</u>	<u>Description of Loading Conditions</u>
4	PMF, full uplift, 3' tailwater, reservoir at 947.0 (17 feet above spillway crest, or 2 feet above non-overflow section w/no tailwater).

Spillway Section

<u>Case</u>	<u>Factor of Safety Overturning</u>	<u>Location of Resultant from Toe</u>	<u>Factor of Safety Sliding</u>
1	1.92	25.6	3.57
2	1.91	25.6	4.10
3	1.41	18.3	2.54
4	1.26	14.0	2.17

Location of middle 1/3 is 16.7 to 33.4 feet from toe.

Non-Overflow Section

<u>Case</u>	<u>Factor of Safety Overturning</u>	<u>Location of Resultant from Toe</u>	<u>Factor of Safety Sliding</u>
1	2.97	16.4	44.4
2	2.37	14.3	22.8
3	1.96	12.1	12.0
4	1.62	10.5	8.6

Location of middle 1/3 is 6.3 to 12.7 feet from toe.

These results indicate that the non-overflow section is stable for all design conditions. The spillway is stable for all design conditions except Case 4 - PMF, where the location of the resultant falls outside the middle 1/3 of the base. Further analysis indicates that for any storm less than 65% of the PMF, the resultant remains within the middle 1/3 of the base. Also, the factors of safety of sliding for the spillway section fall below the recommended value of 3.0 for Cases 3 and 4. This is not believed to be a problem, since rock bolting at the toe of the spillway was conducted to strengthen the passive wedge formed at the base. This factor was not taken into account in the stability program and would significantly increase these values to levels above the minimum requirements for factors of safety against sliding.

It is recommended that additional stability analyses be conducted to more accurately determine the factors of safety and location of the resultant for all cases concerning the spillway section. This investigation should be conducted in conjunction with the investigation of the bedrock jointing beneath the dam. The dam is located in seismic zone 1. Seismic forces are not considered to be of significant magnitude to influence the stability of the structure.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase 1 Inspection of Mongaup Falls Dam did not indicate conditions which constitute an immediate hazard to human life or property. The earth embankment portion is not considered to be unstable. However, there are a number of problem areas if not investigated have the potential for the development of hazardous conditions. These areas are:

1. Unacceptable factors of safety for the spillway section during the PMF and $\frac{1}{2}$ PMF events.
2. Seepage on the east wall of the gate house above the penstock, and deterioration of concrete at the north spillway buttress, the gate house, the intake wingwalls of the gate house, and the non-overflow section.
3. Jointing of the bedrock in the outlet and downstream channels which may extend beneath the dam.
4. Seepage at the north and south ends of the spillway through the bedrock abutments and the buttress walls.

b. Adequacy of Information

The information reviewed is adequate for Phase 1 Inspection purposes.

c. Urgency

Investigation of the four problem areas listed above must be completed within 1 year of notification to the owner. The investigations should include, but not be limited to, coring of the gate house structure to determine the integrity of the concrete and cause of the observed seepage, and subsurface explanation of the outlet channel and foundation of the spillway with drill holes to determine the extent of bedrock jointing. These drill holes may also be used to determine the uplift forces beneath the dam to aid in stability investigations. In addition, weirs or other monitoring devices must be installed immediately and measurements taken bi-weekly to monitor the flow of seepage at all locations. Remedial action, as a result of these investigations, should be completed within the following construction season. Vegetative trimming of the earth embankment and backfilling of the near by depressions should be completed during this construction season.

d. Need for Additional Investigations

To prevent the development of potentially hazardous conditions, investigations are required in the following areas:

1. Structural stability of the spillway section.
2. Seepage on the east wall of the gate house and deterioration of concrete on all elements of the dam north of the spillway.
3. Jointing of the bedrock at the toe and beneath the dam.
4. Seepage at each end of the spillway through the buttresses and the bedrock abutments.

7.2

RECOMMENDED MEASURES

- a. Results of the aforementioned investigations will determine the type and extent of remedial measures required.

The following improvements can be accomplished by maintenance forces:

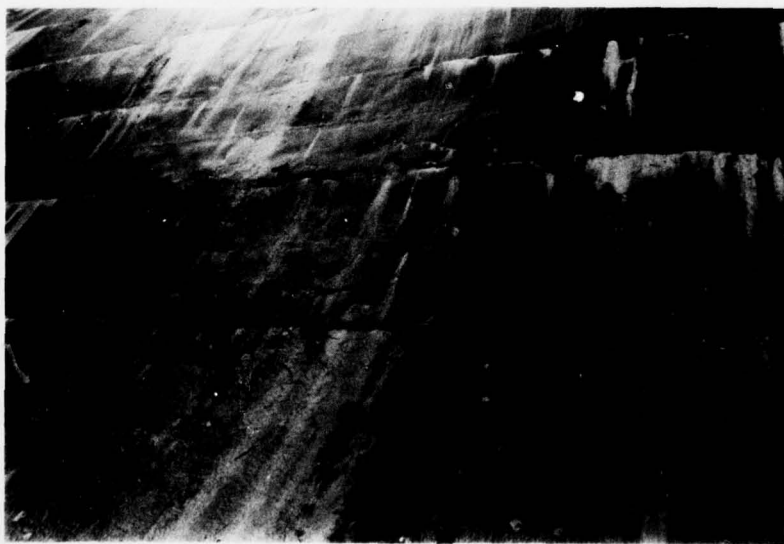
- b. Trim the vegetative growth observed on the earth embankment, including that noted near the south spillway buttress.
- c. Backfill the depressions noted on the upstream side of the earth embankment in the original grade.
- d. Initiate a program of periodic inspection and maintenance of the dam and appurtenances. Document this information for future reference. Also, develop an operations manual.

APPENDIX A

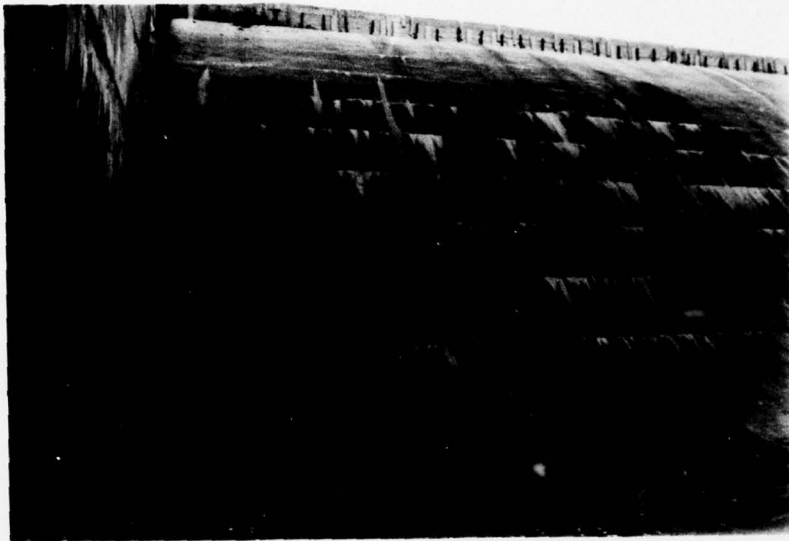
PHOTOGRAPHS



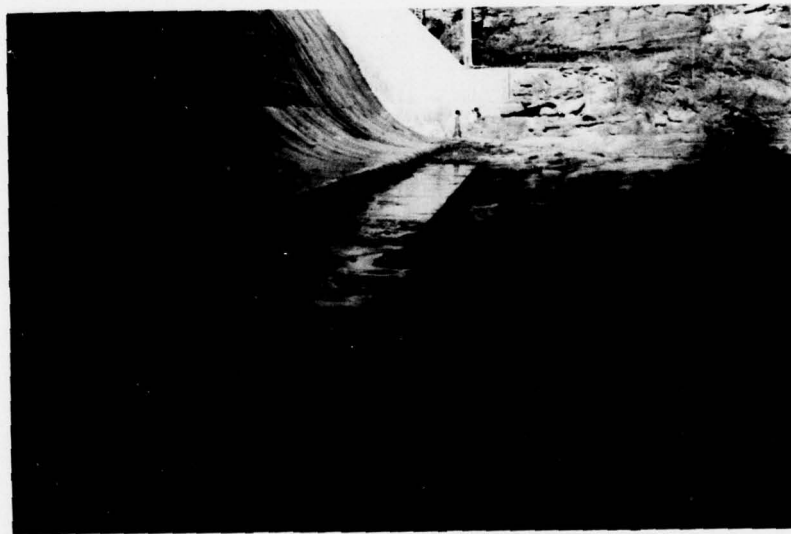
Spillway Viewed from Upstream
Note Flashboards
Photo #3



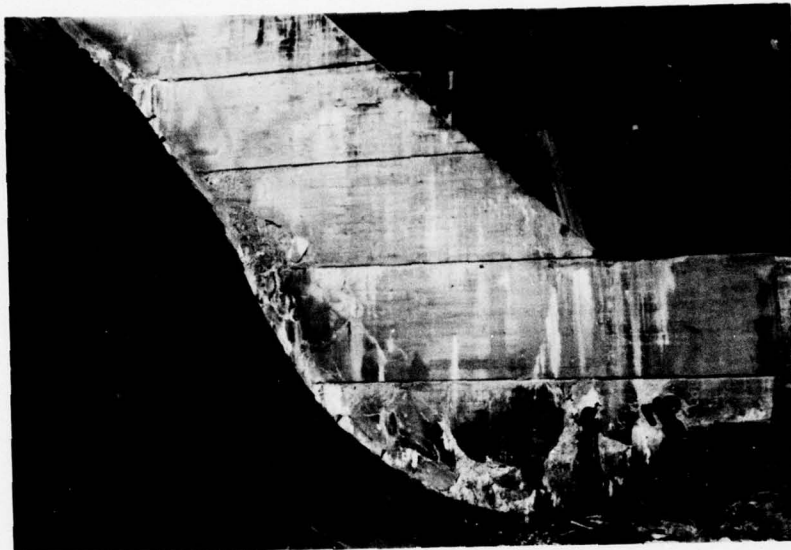
Face Drains Through Gunite Treated Spillway
Photo #4



South Abutment Wall and Spillway Viewed from Downstream
Note Deterioration and Calcification
Photo #5



Spillway Viewed from Downstream
Note Poured Concrete at the Toe of Spillway
and
Water Pool on the Right Corner
Photo #6



North Abutment Wall and Spillway
Note Seepage and Deterioration
Photo #7



Closeup View of Seepage on Photo #7
Photo #8



South Abutment Wall
Note Cracks on Top
Photo #9



Seepage Near South Abutment
Photo #10

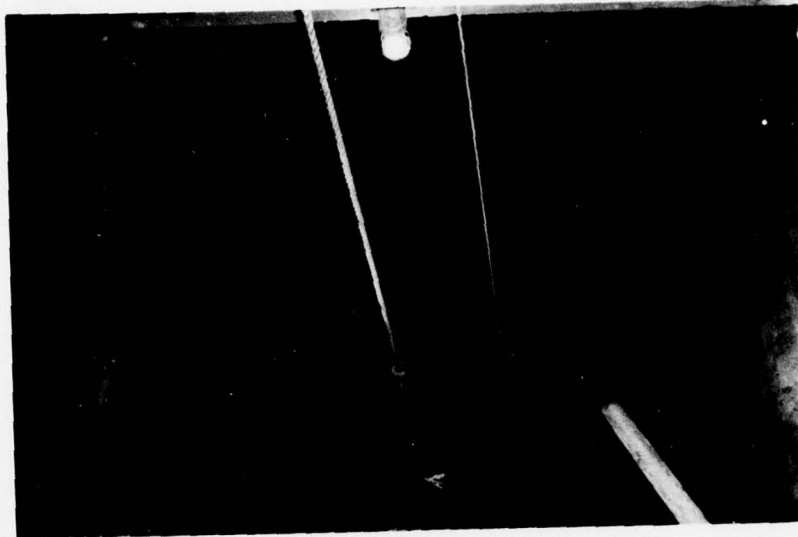


Concrete Retaining Wall and Gate House Viewed from Upstream
Note Concrete Deterioration
Photo #11

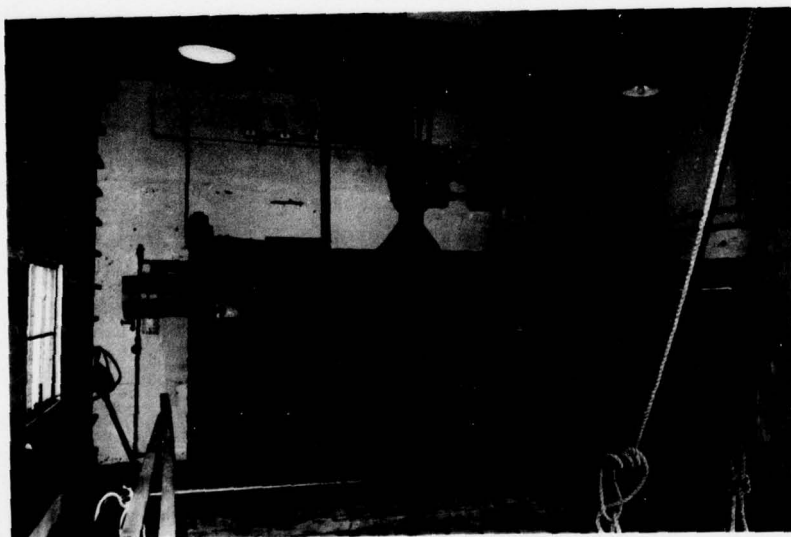


Intake
Note Concrete Deterioration
Photo #12

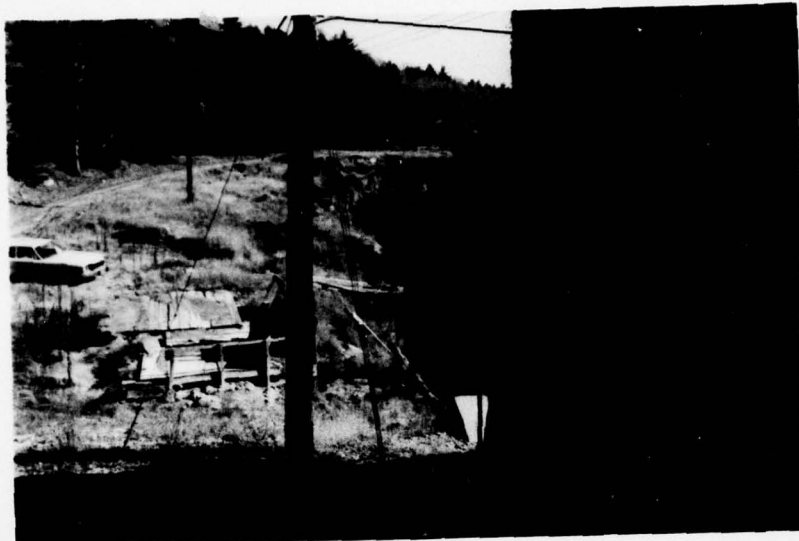
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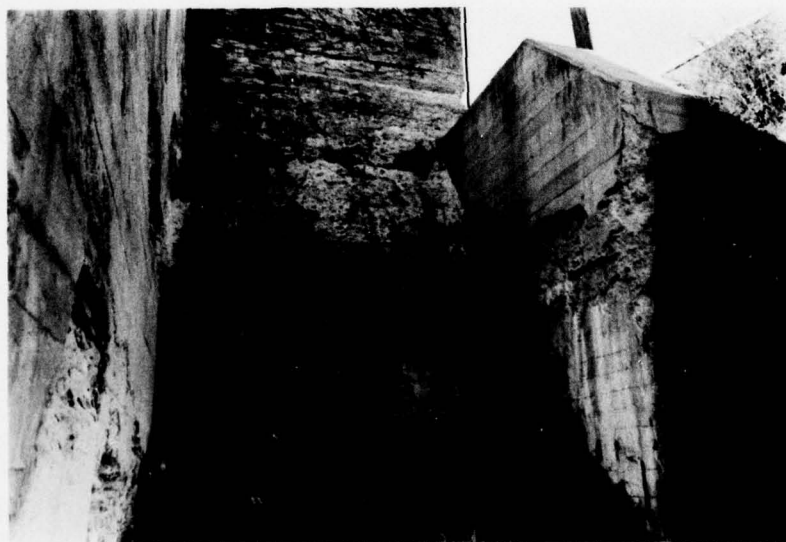
Intake Well
Photo #13



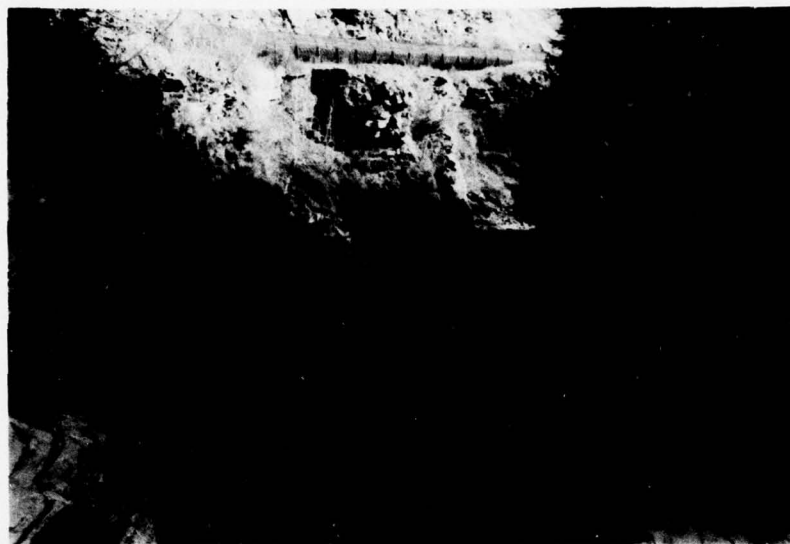
Vertical Slide Gate at Intake
Photo #14



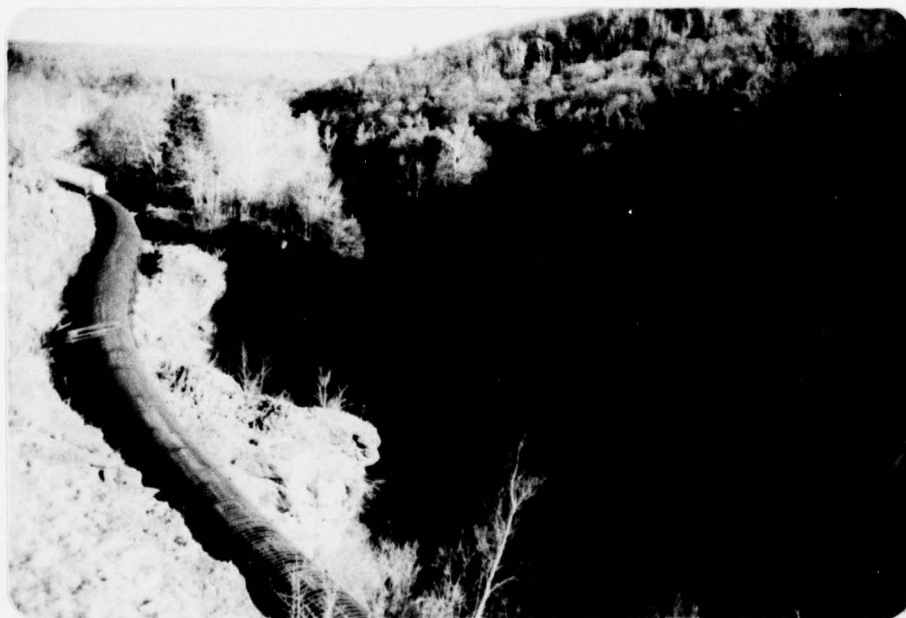
Gate House, Wood Stave Pipe (Penstock), and Access Road
Photo #15



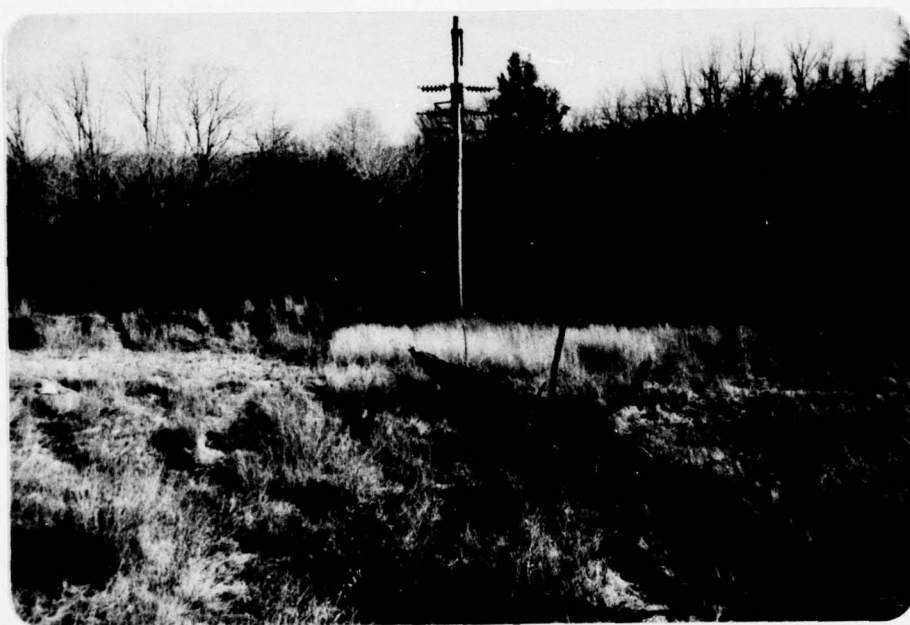
North Abutment (left), Gate House (center), and Retaining Wall (right)
Viewed from Downstream
Note Concrete Deterioration
Photo #16



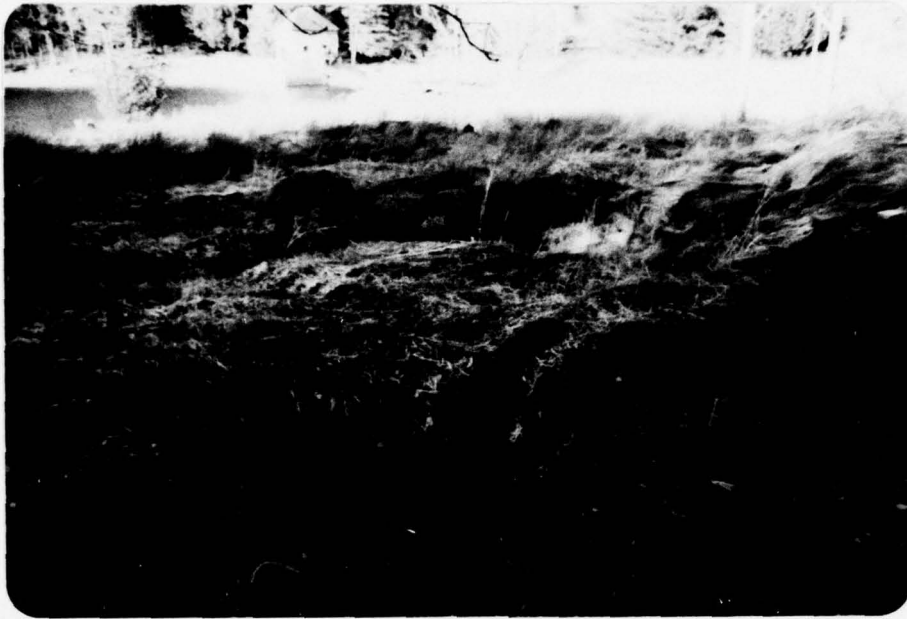
Downstream Channel Viewed from Spillway Top
Photo #17



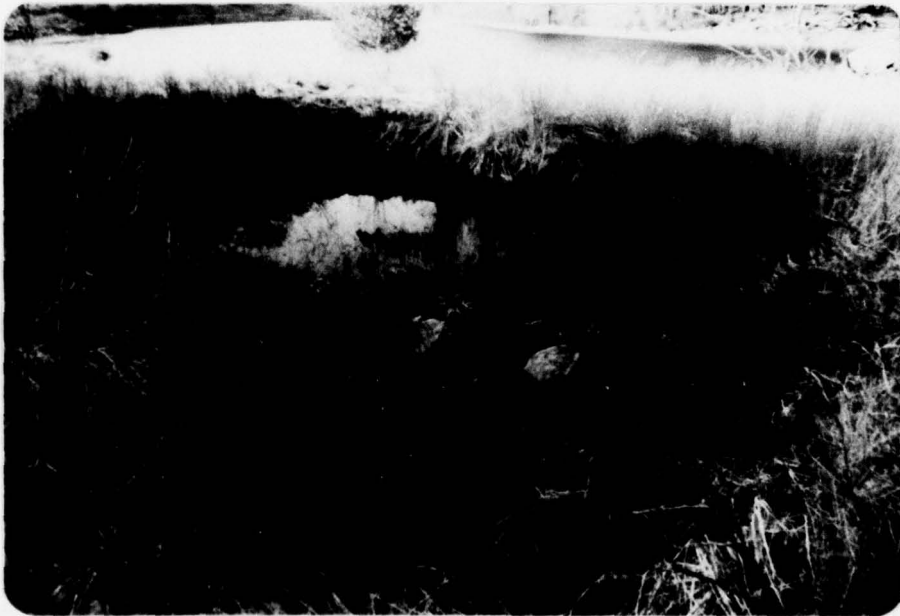
Tailrace Channel and Penstock
Photo #18



Earth Embankment (Closure Dike) in the Background
Southwest of Spillway
Photo #19



Depression on Upstream Side of the Earth Embankment
Photo #20



Pool of Water on Upstream Side of Earth Embankment
Photo #21

APPENDIX B

ENGINEERING DATA CHECKLIST

Check List
Engineering Data
Design Construction Operation

Name of Dam Mongowamp Falls
I.D. # NY 321

Item	Plans	Details	Remarks	Typical Sections
Dam				
Spillway(s)	YES	NO		YES
Outlet(s)	YES	NO		YES
Design Reports	NONE			
Design Computations	NONE			
Discharge Rating Curves	NONE			
Dam Stability				
Seepage Studies	NONE			
Subsurface and Materials Investigations	NONE			

Item	Remarks
Construction History	None
Surveys, Modifications, Post-Construction Engineering Studies and Reports	<p>Ralph Smith Consulting Engrs initiated Program of rock bolting at spillway toe & 400 cy of concrete to insure stability of rock foundation. Also spillway grouted in (1975-76)</p>
Accidents or Failure of Dam Description, Reports	None
Operation and Maintenance Records Operation Manual	Yes

APPENDIX C

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam MONGAUP FALLS

I.D. # N.Y. 321

Location: Town FORESTBURG & LUMBERLAND County SULLIVAN

Stream Name MANGAUP RIVER

Tributary of DELAWARE RIVER

Longitude (W), Latitude (N) 74° 46' 20" , 41° 32' 15'

Hazard Category C

Date(s) of Inspection NOV. 8, 1978 , Apr 20, 1979

Weather Conditions 40's CLEAR, SUNNY

b. Inspection Personnel ROBERT MCCARTY, MUHAMMAD ISLAM,
KENNETH FIELD.

c. Persons Contacted KENNETH FIELD (914) 627-2410
ROBERT STUBER (914) 429-3061

d. History:

Date Constructed JUNE 20, 1923

Owner ORANGE AND ROCKLAND UTILITIES INC.

Designer R.R. LIVINGSTON, 2 RECTOR ST. NYC

Constructed by -

2) Technical Data

Type of Dam CONCRETE ABUTMENT, EARTH EMBANKMENT WITH CONCRETE
CORE WALL

Drainage Area 160 SQUARE MILES

Height 60 FT. Length 218 FT.

Upstream Slope vertical Downstream Slope 3:1

80

2) Technical Data (Cont'd.)

External Drains: on Downstream Face NONE OTHER @ Downstream Toe NONE
THAN FACE DRAINS IN SPILLWAY.

Internal Components:

Impervious Core CONCRETE CORE WALLS ON BOTH SIDES OF SPILLWAY.

Drains NONE

Cutoff Type CONCRETE CUTOFF WALLS UNDER SPILLWAY AND CORE WALLS.

Grout Curtain NONE

3) Embankment

Earth dike on south of spillway.

a. Crest

(1) Vertical Alignment Good

(2) Horizontal Alignment Good

(3) Surface Cracks None observed

(4) Miscellaneous -

b. Slopes

(1) Undesirable Growth or Debris, Animal Burrows Heavy weeds.
should be trimmed and mowed.

(2) Sloughing, Subsidence or Depressions 3 depressions on
upstream side of dike. Source or reason unknown.

(3) Slope Protection None

(4) Surface Cracks or Movement at Toe None observed

(5) Seepage

(6) Condition Around Outlet Structure No outlet other
than penstock.

c. Abutments

(1) Erosion at Embankment and Abutment Contact _____

None

(2) Seepage along Contact of Embankment and Abutment _____

None

(3) Seepage at toe or along downstream face _____

None

d. Downstream Area - below embankment

Good

(1) Subsidence, Depressions, etc. _____

None

(2) Seepage, unusual growth _____

None

(3) Evidence of surface movement beyond embankment toe _____

None

(4) Miscellaneous _____

—

e. Drainage System

None

(1) Condition of relief wells, drains, etc. _____

None

(2) Discharge from Drainage System _____

None

4) Instrumentation

(1) Monumentation/Surveys NONE

(2) Observation Wells NONE

(3) Weirs NONE

(4) Piezometers NONE

(5) Other AUTOMATIC WATER LEVEL RECORDING GAGE

5) Reservoir

a. Slopes O.K.

b. Sedimentation NONE REPORTED

6) Spillway(s) (including tail race channel)

- a. General The spillway was treated with gunite in 1975-76. Numerous small face drains were installed on the spillway to avoid pressure buildup between concrete of spillway and gunite.
- b. Principle Spillway moss and dirt buildup was observed. Calcification, especially along horizontal gunite joints was obvious. Some debris was noticed at the base of spillway and on the joint of spillway and north abutment.

c. Emergency or Auxiliary Spillway

None

d. Condition of Tail race channel

Good

e. Stability of Channel side/slopes channel floor and sides in rock. Stable

7) Downstream Channel

a. Condition (debris, etc.) clean.

b. Slopes

channel is rock. Slopes almost vertical.

No problems observed.

c. Approximate number of homes

8) Miscellaneous Flow through a 6" drain pipe was approximately 25 gpm.

This was collected from hills north of spillway. The
2 other pipes were dry. All three pipes came through the wing wall
north of spillway. Flow through a pipe south of south (abutment) wing
wall was approximately 15 gpm. This water was collected
at from the hills south & west of spillway.

Water ponded below the spillway near the south end.

9) Structural

- a. Concrete Surfaces Concrete surfaces deteriorated and spalled in many places especially around the gate house, wing walls, abutments, non-overflow section and joints.
- b. Structural Cracking There were a vertical and a horizontal crack on the south wing wall. Some small cracks on north wingwall and on non-overflow section north of spillway.
- c. Movement - Horizontal & Vertical Alignment (Settlement) None observed.
- d. Junctions with Abutments or Embankments Concrete deteriorated and spalled at junctions of spillway and abutments, and abutment and wing walls.
- e. Drains - Foundation, Joint, Face None
- f. Water passages, conduits, sluices None. Only one wooden penstock.
- g. Seepage or Leakage Water was leaking through penstock. It could not be determined if the spillway was leaking too. Seepage evident on east wall of gate house above penstock should be investigated.

- h. Joints - Construction, etc. significant calcification at granite joints.
- i. Foundation The dam is founded on solid rock. No problem anticipated.
- j. Abutments Concrete deteriorated and spalled.
- k. Control Gates A vertical gate controls the flow to the penstock. The gate is operated from time to time but the penstock is not closed completely. The gate operated electrically.
- l. Approach & Outlet Channels Approach channel is under water; not visible. Outlet channel is clean and stable.
- m. Energy Dissipators (plunge pool, etc.) None
- n. Intake Structures Intake structure is located in the gate house. Some deterioration of concrete was observed in the tower. There was severe deterioration of concrete around the outside of gate house.
- o. Stability A structural stability analysis was done by Ralph Smith Consulting Engineering firm. It was found that
- p. Miscellaneous stability was low against sliding. Subsequently, 400 cubic yard of concrete was placed at the base of the spillway.

APPENDIX D

HYDROLOGIC/HYDRAULIC

ENGINEERING DATA AND COMPUTATIONS

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

1

AREA-CAPACITY DATA:

	<u>Elevation</u> (ft.)	<u>Surface Area</u> (acres)	<u>Storage Capacity</u> (acre-ft.)
1) Top of Dam	<u>945</u>	<u>170</u>	<u>3500</u>
2) Design High Water (Max. Design Pool)	<u>942</u>	<u>160</u>	<u>3000</u>
3) Auxiliary Spillway Crest	<u>-</u>	<u>-</u>	<u>-</u>
4) Pool Level with Flashboards	<u> </u>	<u> </u>	<u> </u>
5) Service Spillway Crest	<u>930</u>	<u>140</u>	<u>1200</u>

DISCHARGES

	<u>Volume</u> (cfs)
1) Average Daily	<u>Unknown</u>
2) Spillway @ Maximum High Water	<u>21,500</u>
3) Spillway @ Design High Water	<u>21,500</u>
4) Spillway @ Auxiliary Spillway Crest Elevation	<u>-</u>
5) Low Level Outlet	<u>-</u>
6) Total (of all facilities) @ Maximum High Water	<u>21,500</u>
7) Maximum Known Flood	<u>Unknown</u>

CREST:

ELEVATION: 945Type: CONCRETE ABUTMENT, EARTH EMBANKMENT WITH CONCRETE CORE WALLS.Width: _____ Length: 218 FT.Spillover CONCRETE OGEELocation SOUTH OF SERVICE ROAD AND GATE HOUSE

SPILLWAY:

PRINCIPAL

EMERGENCY

930 Elevation N/AOGEE Type _____155.2 FEET Width _____

Type of Control

YES Uncontrolled _____~~Controlled:~~4.8' HIGH FLASHBOARDS Type _____Collapse at 2' of water over flashboards. (Flashboards; gate)

Number _____

Size/Length _____

Invert Material _____

Anticipated Length
of operating service _____- Chute Length _____40 FEET Height Between Spillway Crest
& Approach Channel Invert
(Weir Flow)

OUTLET STRUCTURES/EMERGENCY DRAWDOWN FACILITIES:

Type: Gate _____ Sluice _____ Conduit _____ Penstock YESShape : CIRCULARSize: 8 FEET DIAMETER WOOD STAVE PIPE (PENSTOCK)Elevations: Entrance Invert 901Exit Invert 829.5Tailrace Channel: Elevation 890

HYDROMETEROLOGICAL GAGES:

Type : NONE

Location: _____

Records:

Date - _____

Max. Reading - _____

FLOOD WATER CONTROL SYSTEM:

Warning System: NONE

Method of Controlled Releases (mechanisms):

ONLY THROUGH PENSTOCK, ELECTRICALLY OPERATED
GATE IN GATE HOUSE CAN SHUT OFF SUPPLY TO PENSTOCK.

DRAINAGE AREA: 160 SQUARE MILES

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: /

Terrain - Relief: /

Surface - Soil: /

Runoff Potential (existing or planned extensive alterations to existing
(surface or subsurface conditions)

NONE

Potential Sedimentation problem areas (natural or man-made; present or future)

NONE

Potential Backwater problem areas for levels at maximum storage capacity
including surcharge storage:

NONE

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the
Reservoir perimeter:

Location: /

Elevation: /

Reservoir:

Length @ Maximum Pool 2.35 (Miles)

Length of Shoreline (@ Spillway Crest) 4.88 (Miles)

Mongaup Falls Dam

Drainage area = 160 square miles

From "Upper Delaware River Basin Hydrologic Flood Routing Model" Study, subbasin 51 (49+50+51); page T8 to F7: (= Station 4335.00 Mongaup River near Mongaup)

Area of Station 4335.00 = 202 sq. mi.

Drainage area of Mongaup Falls Dam consists of subbasin 49, 50 and upper part of 51.

Modif. \rightarrow Standard Project Flood (MSPF) = $\frac{1}{2}$ PMF

MSPF = 22,820 cfs (Node 123; Sta. 4335; D.A. 202 sq. mi.)

PMF₁ = 2 \times 22820 = 45,640 cfs

$$\frac{PMF_1}{PMF_2} = \left(\frac{A_1}{A_2}\right)^{3/4} \quad \text{or} \quad \frac{45,640}{PMF_2} = \left(\frac{202}{160}\right)^{3/4}$$

PMF₂ = 38,320 \approx 38,000 cfs

$\frac{1}{2}$ PMF = 19,000 cfs

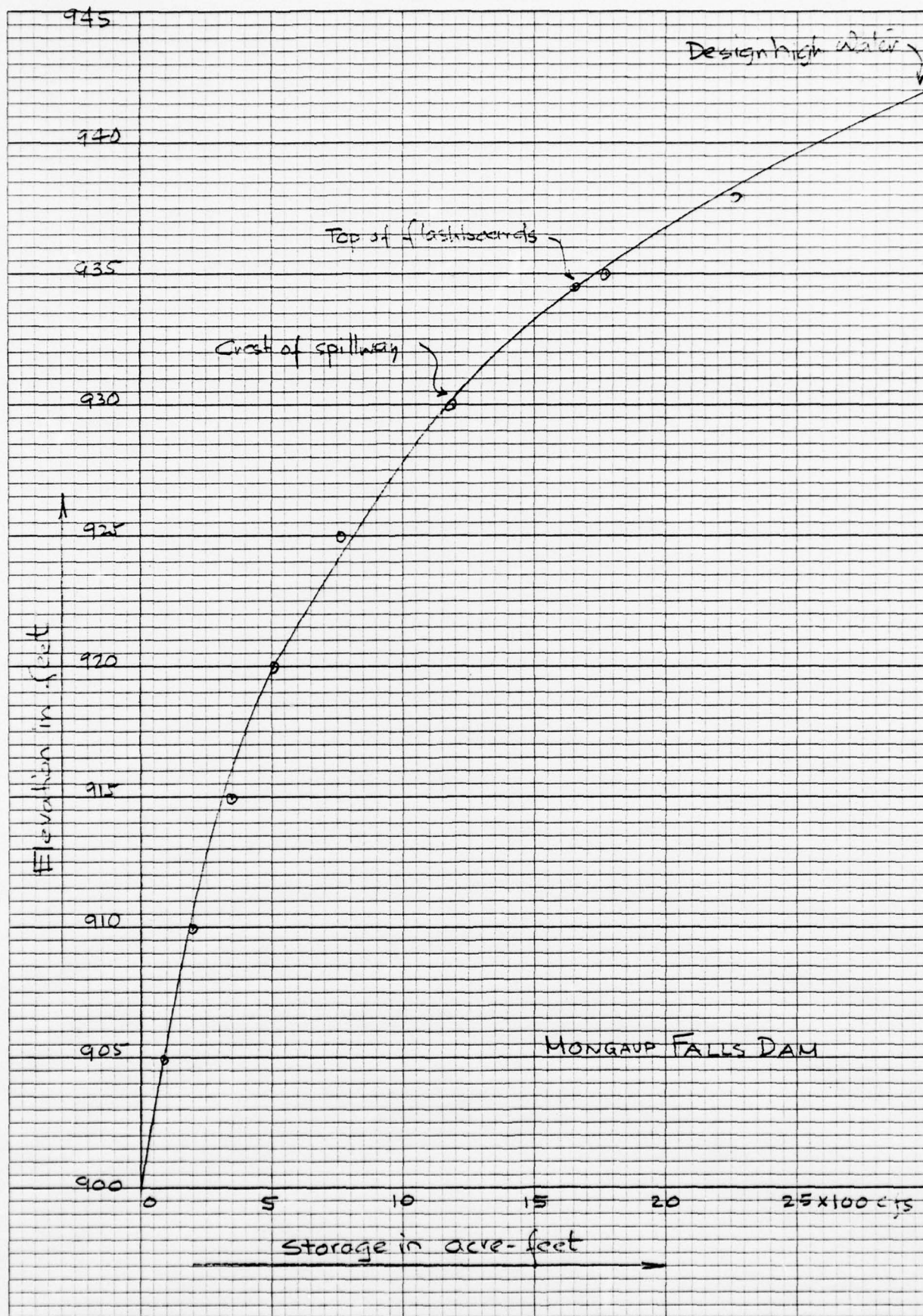
MONGAP FALLS

STORAGE CAPACITY CURVE

Elevation (feet)	Storage (acre-feet)
900	0
905	92
910	196
915	345
920	506
925	759
930	1196
935	1783
938	2266
942	3000

46 0700

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SPILLWAY RATING CURVE

MONGAUP FALLS

$$C = 3.27 + 0.4 \frac{H}{h}$$

where C = Coefficient of discharge

H = Head over spillway

h = Height of spillway

L = Crest length of spillway

L' = Measured length of spillway

N = No. of end contractions

H' = Head over flashboards

$$L = L' - 0.1NH$$

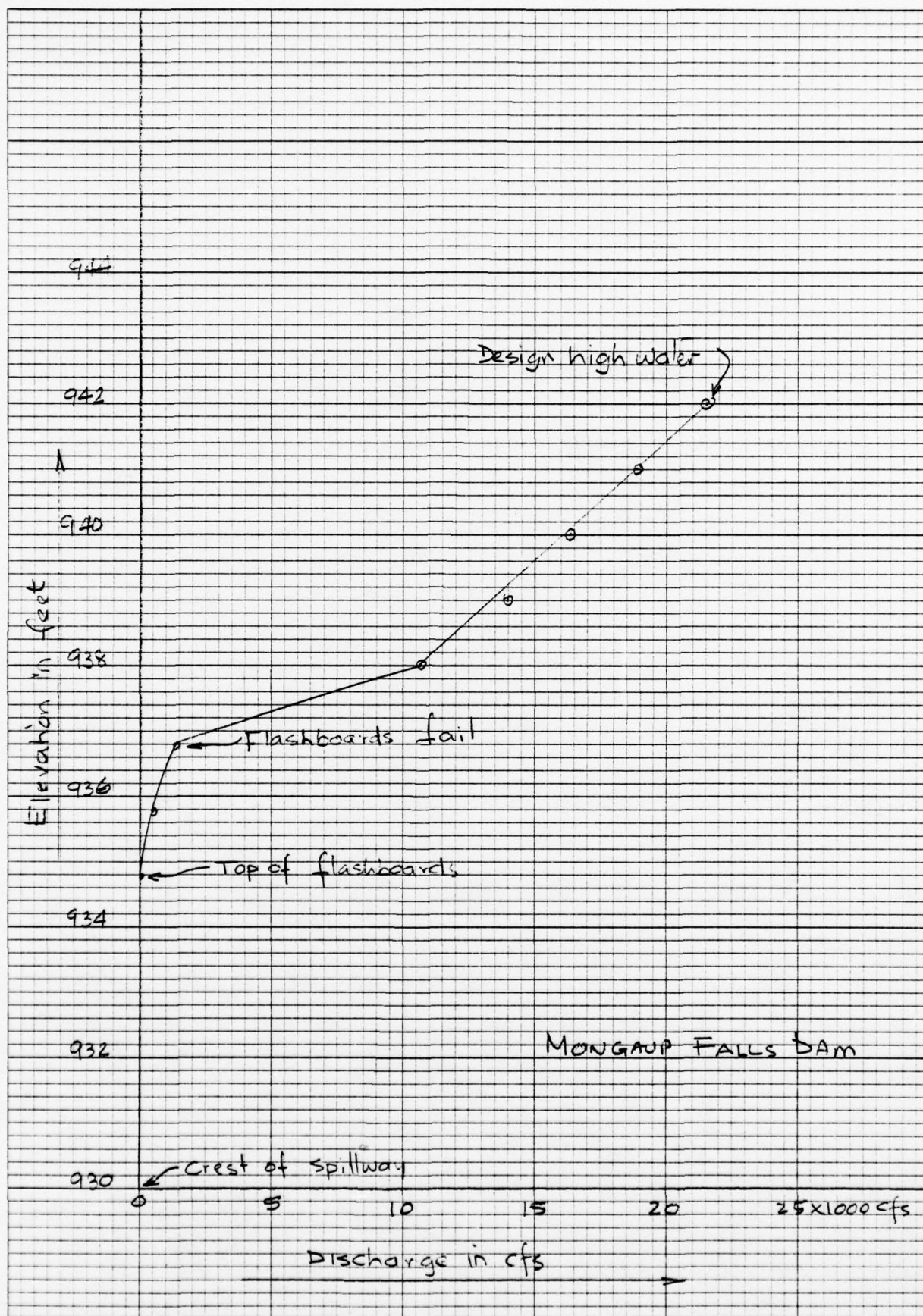
$$Q = CLH^{3/2}$$

$$L' = 155.2 \text{ feet}, \quad N = 2$$

Elevation (feet)	H (feet)	H' (feet)	h (feet)	C	L (feet)	Q (cfs)	Remarks
931.0	1.0	0	44.8			0	
932.0	2.0	0	44.8			0	
933.0	3.0	0	44.8			0	
934.0	4.0	0	44.8			0	
934.8	4.8	0	44.8			0	
935.8	5.8	1	44.8	3.28	155	508	
936.8	6.8	2	44.8	3.29	154.8	1,440	
938.0	8.0	No flash- boards.	40.0	3.35	153.6	11,643	Flashboards Collapse
939.0	9.0		40.0	3.36	153.4	13,916	
940.0	10.0		40.0	3.37	153.2	16,326	
941.0	11.0		40.0	3.38	153.0	18,867	
942.0	12.0		40.0	3.39	152.8	21,533	
945.0	15.0		40.0	3.42	152.2	30,240	

46 0700

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Overtopping

$$Q = CLH^{3/2}$$

$$\begin{aligned} 38,000 &= \overset{\textcircled{1}}{3.39 \times 155 \times H^{3/2}} + \overset{\textcircled{2}}{3.3 \times 500 \times (H-15)^{3/2}} \\ &= 525.45 H^{3/2} + 1650 (H-15)^{3/2} \end{aligned}$$

$$H = 16.5 \text{ feet}$$

or 1.5 feet above top of dam

① = Spillway Section

② = Embankment Section

Q = Discharge in cfs

C = Coefficient of discharge

L = Length (ft.)

H = Head (ft.)

LIST OF REFERENCES

APPENDIX E

APPENDIX E

REFERENCES

- 1) U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, May 1961.
- 2) Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, August 1972 (U.S. Department of Agriculture).
- 3) H.W. King and E.F. Brater, Handbook of Hydraulics, 5th edition, McGraw-Hill, 1963.
- 4) T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley and Sons, 1965.
- 5) W.D. Thornbury, Principles of Geomorphology, John Wiley and Sons, 1969.
- 6) University of the State of New York, Geology of New York, Education Leaflet 20, Reprinted 1973.
- 7) Cornell University Agriculture Experiment Station (compiled by M.G. Cline and R.L. Marshall), General Soil Map of New York State and Soils of New York Landscapes, Information Bulletin 119, 1977.

APPENDIX F

STABILITY ANALYSES

MONGAUP FALLS
STABILITY ANALYSIS

A stability analysis was performed on the subject dam with the use of a Texas Instruments Model #TI-59 Programmable calculator. A listing of the program may be obtained upon request.

Spillway Section

The following cases apply for the spillway section:

<u>Case</u>	<u>Description of Loading</u>
1	Normal loads, full uplift, 3' tailwater, reservoir at 933.
2.	Ice loading (5 K/ft.), full uplift, 3' tailwater, ice at 928.
3	$\frac{1}{2}$ PMF, reservoir at 942, 12 ft. over crest, full uplift, 3' tailwater.
4	PMF, reservoir at 947, 17 ft. over crest, full uplift, 3' tailwater.

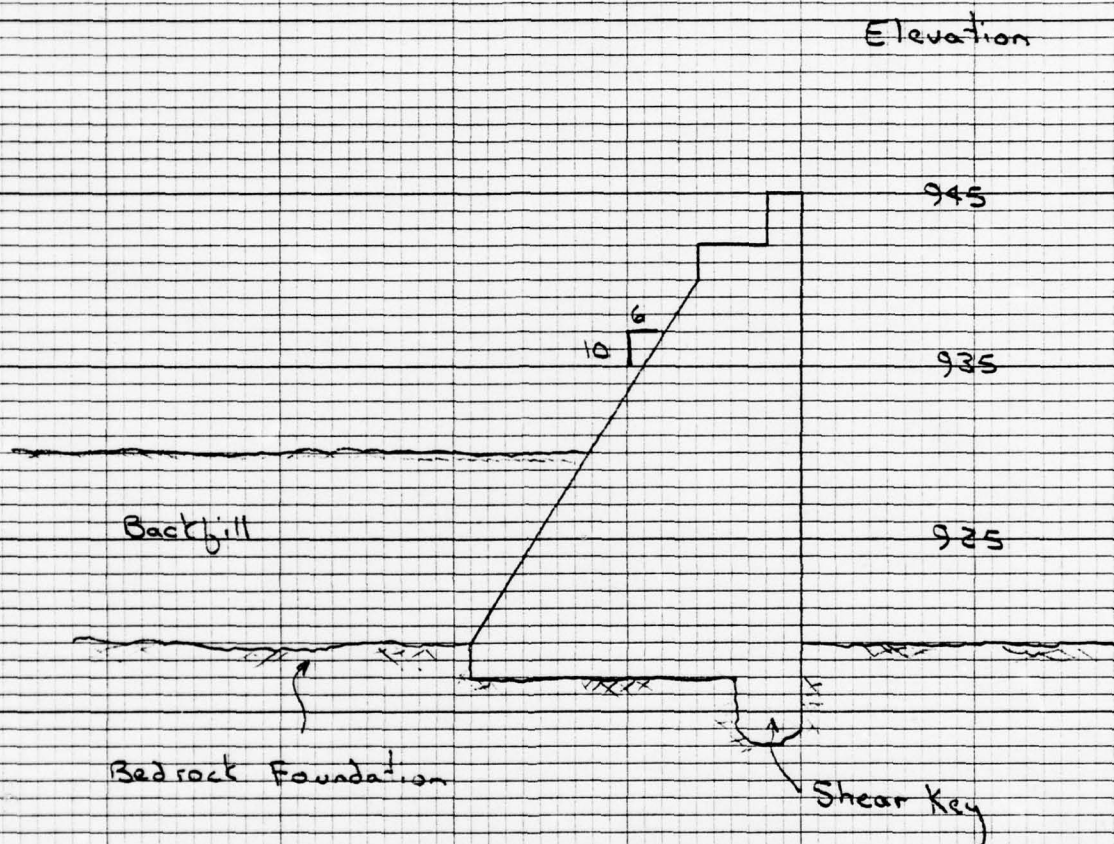
Non-Overflow Section

The following cases apply for the non-overflow section:

<u>Case</u>	<u>Description of Loading</u>
1	Normal loads, full uplift, no tailwater, reservoir at 933.
2	Ice load (5 K/ft.), full uplift, no tailwater, ice at 933.
3	$\frac{1}{2}$ PMF, reservoir at 942, 3.0 feet below top of dam, full uplift, no tailwater.
4	PMF, reservoir at 947, 2.0 feet over top of dam, full uplift, no tailwater.

NOTE: A shear key located at the heel of the dam contributes to the sliding resistance of the dam. The stability analysis does not include this option. Therefore, the additional calculations below the computed factors of safety are shown to account for the benefit of the shear key.

Mongaup Falls Dam Non-Overflow Section



Scale 1" = 10'

middle $\frac{1}{3}$ of base ranges
from 6.3' to 12.7'

INPUT FOR STABILITY ANALYSIS PROGRAM

<u>Input Parameter</u>	<u>Value</u>			
	<u>Case 1</u>	<u>Case 2</u>	<u>Case 3</u>	<u>Case 4</u>
0 Unit Weight of Dam (K/ft. ³)	.15	.15	.15	.15
1 Area of Segment #1 (ft. ²)	56	56	56	56
2 Location of Center of Gravity from toe (ft.) Segment #1	18.0	18.0	18.0	18.0
3 Area of Segment #2 (ft. ²)	112	112	112	112
4 Location of CG from toe, Seg. #2 (ft.)	15.0	15.0	15.0	15.0
5 Area of Segment #3 (ft. ²)	150	150	150	150
6 Location of CG from toe, Seg. #3 (ft.)	8.7	8.7	8.7	8.7
7 Total Base Width of Dam (ft.)	19.0	19.0	19.0	19.0
8 Height of Dam (ft.)	28.0	28.0	28.0	28.0
9 Ice Loading (K/L.F.)	0	5.0	0	0
10 Coefficient of Sliding	.6	.6	.6	.6
11 Unit Weight of Soil (K/ft. ³)	.17	.17	.17	.17
12 Coefficient of Active Soil Pressure - Ka	0	0	0	0
13 Coefficient of Passive Soil Pressure - Kp	3.5	3.5	3.5	3.5
14 Height of Water over Top of Dam (ft.)	0	0	0	2.0
15 Height of Soil for Active Pressure (ft.)	0	0	0	0
16 Height of Soil for Passive Pressure (ft.)	13.0	13.0	13.0	13.0
17 Height of Water in Tailrace Channel (ft.)	0	0	0	0

INPUT FOR STABILITY ANALYSIS PROGRAM

<u>Input Parameter</u>	<u>Value</u>			
	<u>Case 1</u>	<u>Case 2</u>	<u>Case 3</u>	<u>Case 4</u>
18 Unit Weight of Water (K/ft. ³)	0.0624	0.0624	0.0624	0.0624
19 Area of Segment #4 (ft. ²)	0	0	0	0
20 Location of CG from toe, Seg. #4 (ft.)	0	0	0	0
46 Height of Ice Load or Active Water	13	13	25	28

Mongaup Falls Dam
Stability Analysis
Non-Overflow Section

Case 1 Normal Loading

Case 2 Ice Loading

(a) 2.966304529
(b) 16.40352365
(d) 11.64281129



4.
1.
144.
300.
1000.
172.8
172.8
172.8

61.50096
61.50096
234.30096
234.30096
234.30096
234.30096

5.2728
5.2728
5.2728

0.
0.
5.2728

0.
0.
5.2728

0.
0.

5.2728
5.2728

(d) 44.43577606

F.S. sliding

for shear key

* Width of Shear Key (ft.)
* Depth of Section (ft.)
* Inches 2/foot²
÷ Shear strength of concrete (psi)
= Pounds/kip

+ Shear Resistance of key (kips)

RCL
45

Sum of Resisting Forces for
= sliding (kips)

RCL

29 Driving force of water (kips)
triangular distribution

RCL

31 Driving force of water (kips)
Rectangular distribution for
+ height above dam

RCL

9 Driving force of ice (kips)

RCL

Driving force of Active Soil (kips)
31 on upstream side of dam

)

= Sum of driving forces for
sliding (kips)

(a) 2.372054791
(b) 14.31359801
(c) 5.983776121



172.8

61.50096

61.50096

234.30096

234.30096

234.30096

234.30096

5.2728

5.2728

5.2728

0.

0.

5.2728

5.

5.

10.2728

0.

0.

10.2728

10.2728

(d) 22.80789658

F.S. sliding

RCL
45

=

+

(

RCL

29

+

RCL

31

+

RCL

9

+

RCL

36

)

=

Mongaup Falls Dam
Stability Analysis
Non-Overflow Section

Case 3 - $\frac{1}{2}$ PMF

(a) 1.962121358
(b) 12.13405741
(c) ~~9.153895385~~



172.8	+	
172.8	RCL	
	45	
61.50096		
61.50096	=	
234.30096		
234.30096	+	
234.30096	(
234.30096	RCL	
	29	
19.5		
19.5	+	
19.5	RCL	
	31	
0.		
0.	+	
19.5	RCL	
	9	
0.		
0.	+	
19.5	RCL	
	36	
0.		
0.)	
19.5		
19.5	=	

(d) 12.01543385

F.S. Sliding

Case 4 PMF

(a) 1.624211455
(b) 10.48461581
(c) ~~2.440597282~~



172.8	+	
172.8	RCL	
	45	
68.2271		
68.2271	=	
241.0271		
241.0271	+	
241.0271	(
241.0271	RCL	
	29	
24.4608		
24.4608	+	
24.4608	RCL	
	31	
3.4944		
3.4944	+	
27.9552	RCL	
	9	
0.		
0.	+	
27.9552	RCL	
	36	
0.		
0.)	
27.9552		
27.9552	=	

(d) 8.621905764

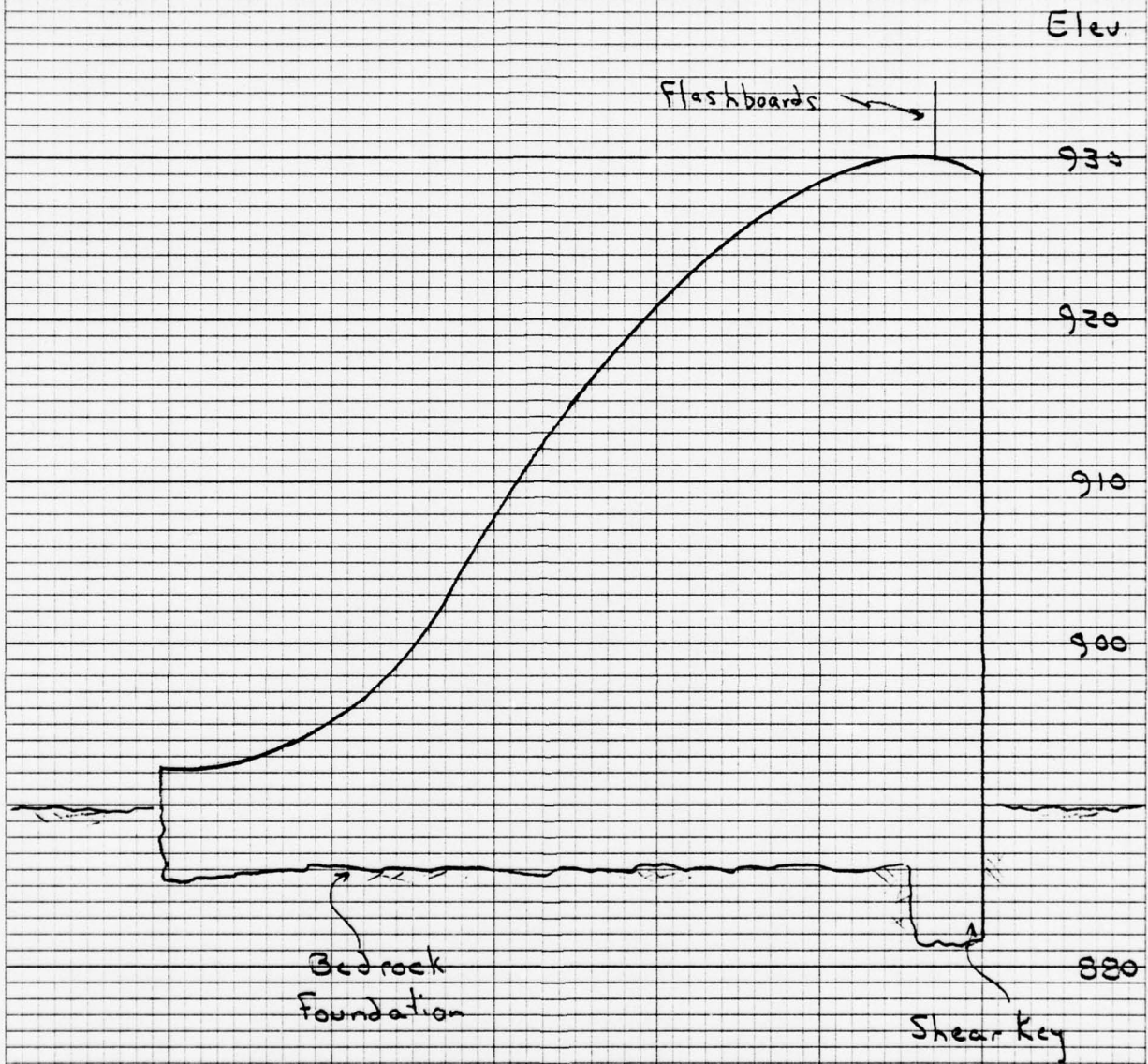
PRT

F.S. Sliding

46 0700

K-E 10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Mongaup Falls Dam Spillway Section



Scale 1" = 10'

middle $\frac{1}{3}$ of base ranges
from 16.7' to 33.9'

INPUT FOR STABILITY ANALYSIS PROGRAM

<u>Input Parameter</u>	<u>Value</u>			
	<u>Case 1</u>	<u>Case 2</u>	<u>Case 3</u>	<u>Case 4</u>
0 Unit Weight of Dam (K/ft. ³)	0.15	0.15	0.15	0.15
1 Area of Segment #1 (ft. ²)	1338	1338	1338	1338
2 Location of Center of Gravity from toe (ft.) Segment #1	33.45	33.45	33.45	33.45
3 Area of Segment #2 (ft. ²)	0	0	0	0
4 Location of CG from toe, Seg. #2 (ft.)	0	0	0	0
5 Area of Segment #3 (ft. ²)	0	0	0	0
6 Location of CG from toe, Seg. #3 (ft.)	0	0	0	0
7 Total Base Width of Dam (ft.)	50.17	50.17	50.17	50.17
8 Height of Dam (ft.)	45.0	45.0	45.0	45.0
9 Ice Loading (K/L.F.)	0	5.0	0	0
10 Coefficient of Sliding	0.6	0.6	0.6	0.6
11 Unit Weight of Soil (K/ft. ³)	.17	.17	.17	.17
12 Coefficient of Active Soil Pressure - Ka	0	0	0	0
13 Coefficient of Passive Soil Pressure - Kp	4.0	4.0	4.0	4.0
14 Height of Water over Top of Dam (ft.)	0	0	12.0	17.0
15 Height of Soil for Active Pressure (ft.)	0	0	0	0
16 Height of Soil for Passive Pressure (ft.)	5.0	5.0	5.0	5.0
17 Height of Water in Tailrace Channel (ft.)	3.0	3.0	3.0	3.0

INPUT FOR STABILITY ANALYSIS PROGRAM

<u>Input Parameter</u>	<u>Value</u>			
	<u>Case 1</u>	<u>Case 2</u>	<u>Case 3</u>	<u>Case 4</u>
18 Unit Weight of Water (K/ft. ³)	0.0624	0.0624	0.0624	0.0624
19 Area of Segment #4 (ft. ²)	0	0	0	0
20 Location of CG from toe, Seg. #4 (ft.)	0	0	0	0
46 Height of Ice Load or Active Water	48	43	45	45

NOTE: On the succeeding pages the following notation will be used:

- (a) is the factor of safety for overturning;
- (b) is the location of the resultant from the toe;
- (c) is the factor of safety for sliding without the benefit of resistance from the shear key;
- (d) is the factor of safety for sliding with the benefit of resistance from the shear key.

Mongaup Falls Dam
Stability Analysis
Spillway Section

Case 1 Normal Loads

(a) 1.915273536
(b) 25.6051421
(c) ~~1.173383336~~



172.8	+	
172.8	RCL	
	45	
84.1200448		
84.1200448	=	
256.9200448		
256.9200448	+	
256.9200448	(
256.9200448	RCL	
	29	
71.8848		
71.8848	+	
71.8848	RCL	
	31	
0.		
0.	+	
71.8848	RCL	
	9	
0.		
0.	+	
71.8848	RCL	
	36	
0.		
0.)	
71.8848		
71.8848	=	
(d) 3.574052439		

F.S. Sliding for
Shear Key

Case 2 Ice Loading

(a) 1.914151008
(b) 25.58873631
(c) ~~1.341267224~~



172.8	+	
172.8	RCL	
	45	
84.1200448		
84.1200448	=	
256.9200448		
256.9200448	+	
256.9200448	(
256.9200448	RCL	
	29	
57.6888		
57.6888	+	
57.6888	RCL	
	31	
0.		
0.	+	
57.6888	RCL	
	9	
5.		
5.	+	
62.6888	RCL	
	36	
0.		
0.)	
62.6888		
62.6888	=	
(d) 4.09034045		

F.S. Sliding

Mongaup Falls Dam
Stability Analysis
Spillway Section

Case 3 - $\frac{1}{2}$ PMF

- (a) 1.410873129
(b) 18.34846795
(c) ~~1.7513907511~~



172.8	+	
172.8	RCL	
	45	
72.849856		
72.849856	=	
245.649856		
245.649856	+	
245.649856	(
245.649856	RCL	
	29	
63.18		
63.18	+	
63.18	RCL	
	31	
33.696		
33.696	+	
96.876	RCL	
	9	
0.		
0.	+	
96.876	RCL	
	36	
0.		
0.)	
96.876		
96.876	=	

- (d) 2.535714274

F.S. SLD:~

Case 4 PMF

- (a) 1.258426044
(b) 13.9619761
(c) ~~1.6144044957~~



172.8	+	
172.8	RCL	
	45	
68.153944		
68.153944	=	
240.953944		
240.953944	+	
240.953944	(
240.953944	RCL	
	29	
63.18		
63.18	+	
63.18	RCL	
	31	
47.736		
47.736	+	
110.916	RCL	
	9	
0.		
0.	+	
110.916	RCL	
	36	
0.		
0.)	
110.916		
110.916	=	

- (d) 2.172400231

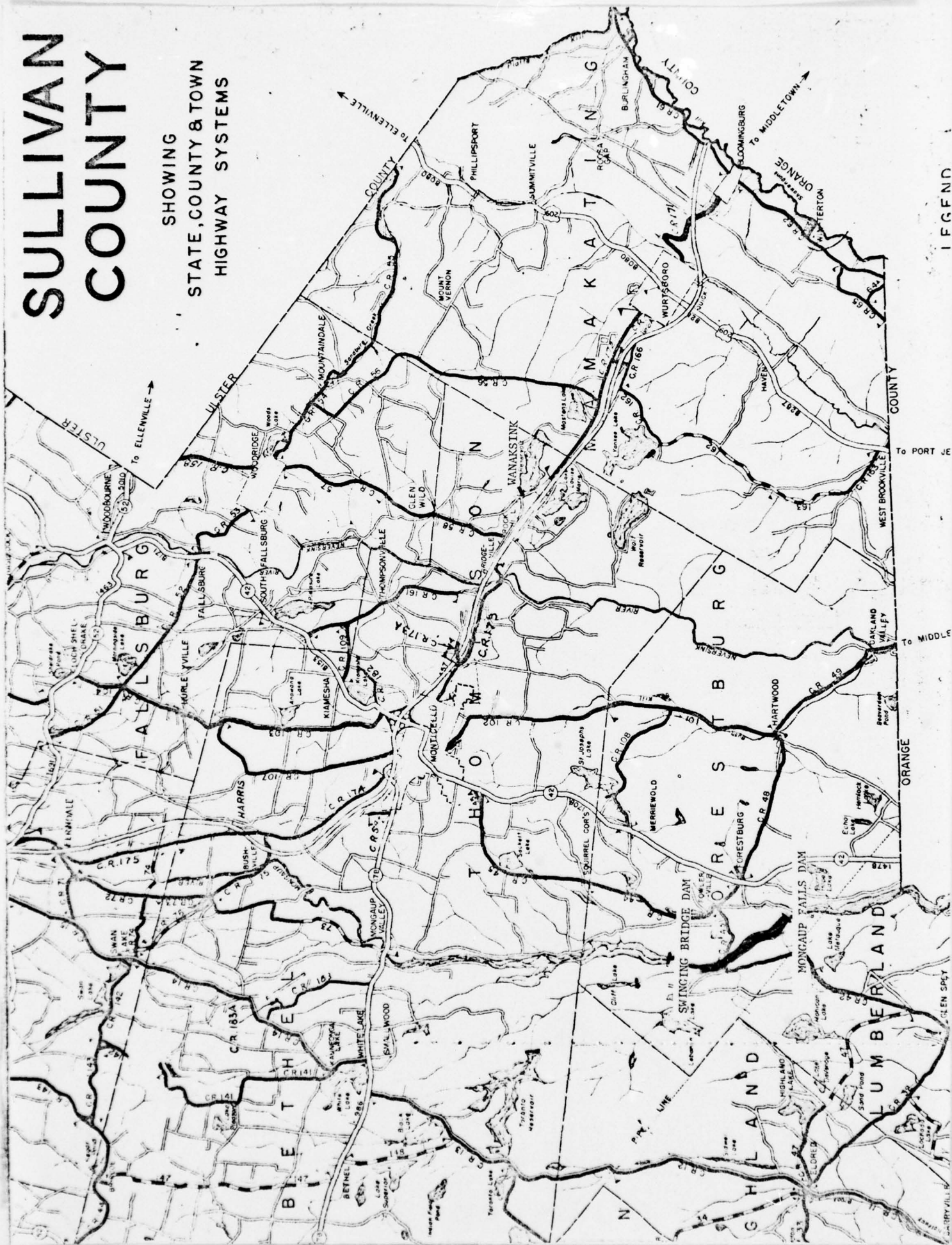
F.S. SLD:~

APPENDIX G

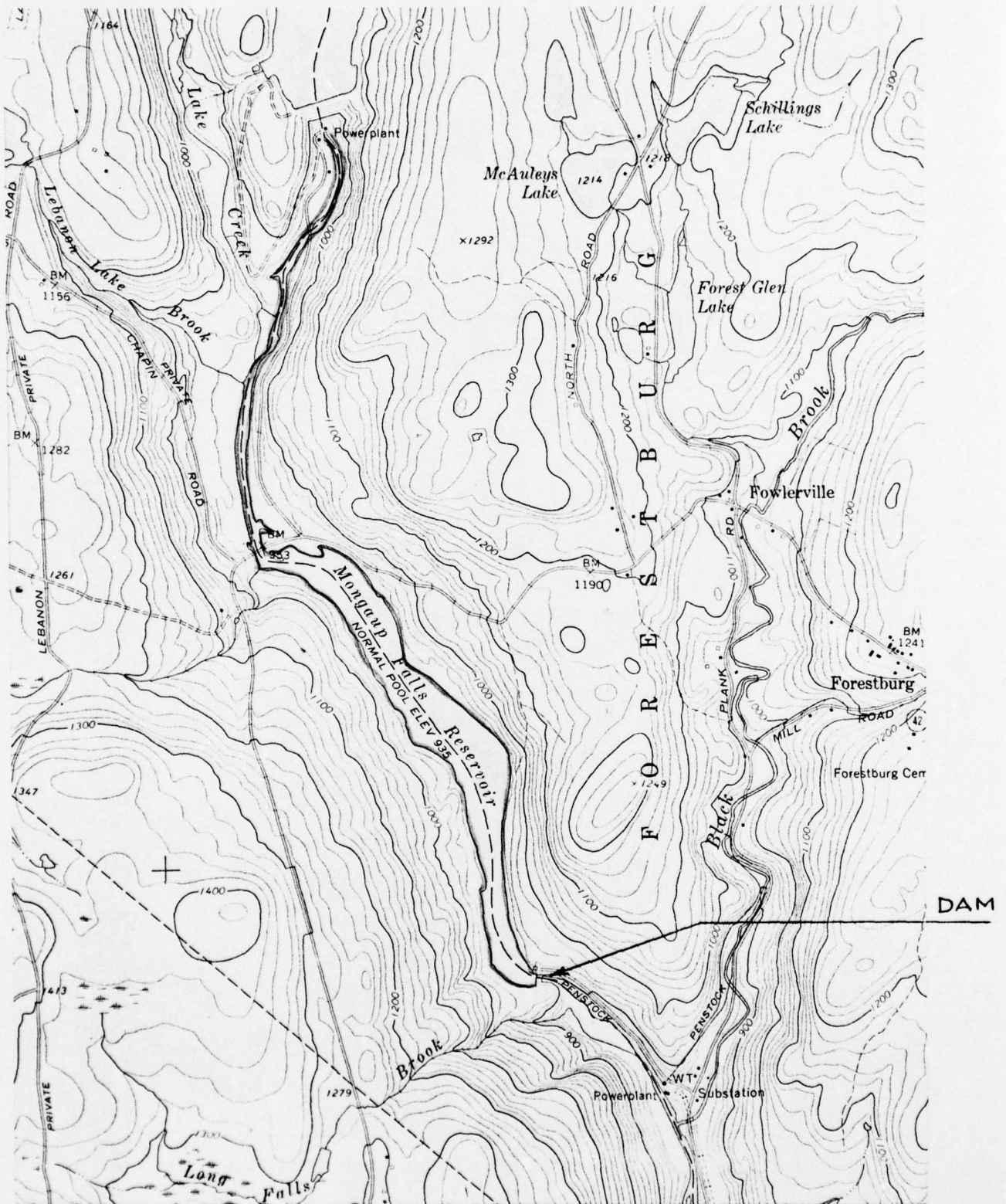
DRAWINGS

SULLIVAN COUNTY

SHOWING
STATE, COUNTY & TOWN
HIGHWAY SYSTEMS



LEGEND



TOPOGRAPHIC MAP

A. C. Stuber

ORANGE AND ROCKLAND UTILITIES, INC.

one blue hill plaza, pearl river, new york, 10965 914-352-6000

writer's direct dial number 914-627-2420

December 7, 1978

Mr. James D. Hebson, Regional Engineer
New York Regional Office
Federal Energy Regulatory Commission
26 Federal Plaza
New York, New York 10007

Subject: Emergency Action Plan in the
Event of Dam Failure at
Project Nos. 2578, 2592 and 2605

Dear Mr. Hebson:

In accordance with your letter dated October 16, 1978, enclosed are three (3) copies of our revised "Monitoring and Emergency Action Plan, Mongaup River Hydroelectric Facilities." The plan provides a detailed procedure for notification of the proper authorities in the event of an emergency, including a list of telephone numbers of persons to be contacted. A contingency plan for alternate means of communication as well as documentation of correspondence with the New York State Police are also attached.

The Company Duty Officer changes each week and a copy of the Duty Officer schedule is provided to the System Operator's office. By copy of this letter the revised Emergency Action Plan is being transmitted to the Superintendent-Hydro Maintenance for immediate posting in his office. All subsequent revisions shall be likewise forwarded to him.

The revised plan includes a list of parties to be notified in the event of an emergency with the State Police having the primary responsibility and authority to effect any orderly evacuation of the areas of potential flooding. Since Orange and Rockland Utilities is the only operator of water-related facilities along the Mongaup River subject to potential flooding in the event of dam failure, the notification of other such operators is not applicable.

The Company's rigid inspection program, which is summarized in the Emergency Action Plan, affords us the opportunity to determine where repairs are required well in advance of their reaching the critical stage. Materials necessary to effect such repairs on a

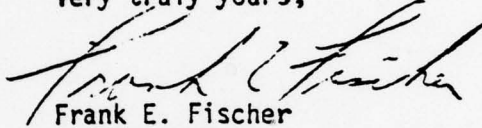
December 7, 1978

timely basis are on hand or are readily available in the area. Therefore, we do not feel the necessity to stockpile additional materials for emergency repairs.

Coordination of flows based on weather forecasts is included in instructions to System Operators. This flow coordination is designed to reduce the risk and amount of potential flooding in the downstream areas.

If we can be of further assistance to you regarding this matter, please do not hesitate to contact us.

Very truly yours,



Frank E. Fischer
Vice President

BZBjr/ct
Atts.

cc: B. Muthig, Capt. (NYS Police)

bcc: T. A. Griffin, Jr.
K. B. Field
B. Z. Baxter, Jr.
F. J. Kiernan (4 copies for distribution)
J. F. Kragh
W. H. Smith
J. O. Trudeau
K. D. Archer

ORANGE AND ROCKLAND UTILITIES, INC.
MONITORING AND EMERGENCY ACTION PLAN
MONGAUP RIVER HYDROELECTRIC FACILITIES

(Revised December 1, 1978)

Inspection Procedures Used To Monitor Condition Of Dams

Swinging Bridge, Mongaup and Rio dams are inspected daily by attendant-operators.

Toronto, Cliff Lake and Lebanon dams are inspected on Monday, Wednesday and Friday of each week by Hydro Maintenance crew members.

Each dam will be inspected once a year by a licensed Civil Engineer.

All dams are inspected every five years by consulting engineers representing the Company Bond Holders.

Other Monitoring Procedures

Pond elevations at Swinging Bridge, Mongaup and Rio are recorded by operators at these plants and relayed to Orange and Rockland System Operators at least every 4 hours during normal working hours and 24 hours per day during times of severe floods. When the new Energy Control Center goes into service in mid-1979, these elevations will be monitored continuously and automatically logged hourly at the System Operator's office in Spring Valley, New York.

Instructions to System Operators and Superintendent-Hydro Maintenance

In case of major floods (over 4 inches of rain in 24 hours or 6 inches in 48 hours), or when the in-flow at Swinging Bridge exceeds 2,000 c.f.s., Superintendent-Hydro Maintenance is instructed to close Toronto reservoir gates (if open) and start opening Swinging Bridge

flood gates at a rate which will hold the Swinging Bridge pond elevation at Elev. 1070 or less.

If the Swinging Bridge pond water elevation rises to Elev. 1071, the top 1.2 feet of flashboards will release over the 125 foot length of boards. When this condition occurs the Superintendent-Hydro Maintenance shall notify the System Operator. The System Operator shall notify the New York State Police that a possible emergency condition is imminent and request that Police stand by, but take no action until further notice. If this release by the top 1.2 feet of flashboards does not cause a drop in the elevation of the Swinging Bridge pond, or if the pond again rises to Elev. 1071, the Superintendent-Hydro Maintenance shall notify the System Operator who will notify the State Police to evacuate the houses in Mongaup Village at the lower end of the Mongaup River. The System Operator shall notify the Company Duty Officer, Manager-Electric Production, and Security Manager of the emergency condition and the action taken. The System Operator shall notify the New York Regional Engineer of the Federal Energy Regulatory Commission or his alternate.

If Swinging Bridge pond level continues to rise to above Elev. 1072, the remaining 5.0 feet of flashboards will be released and the maximum spillway capacity will then be available. The sill of this spillway is at Elev. 1065.

The operation of the entire flashboard system with all gates wide open should control the Swinging Bridge pond level for any anticipated flood. If after the operation of the entire flashboard system the pond level does not drop below Elev. 1071, the Superintendent-Hydro Maintenance shall notify the System Operator who will notify the State Police to evacuate the remaining endangered properties located immediately down-

stream of the Mongaup dam and the Rio recreation area. Notification of the Duty Officer, Manager-Electric Production, Corporate Communications, and Security Manager shall also be accomplished.

In the event, during an emergency condition, the Superintendent-Hydro Maintenance cannot make telephone contact with the System Operator, he shall use the Company two-way radio system. If the System Operator cannot make telephone contact with the State Police, he shall request a messenger with a radio vehicle be immediately dispatched from the Company's Western Division Operations Center in Middletown, New York to go directly to the State Police headquarters, also located in Middletown, to notify them of the emergency condition. The messenger shall remain at police headquarters to maintain direct radio contact between the Superintendent-Hydro Maintenance, System Operator, and the State Police.

MONGAUP RIVER HYDROELECTRIC FACILITIES

EMERGENCY ACTION PLAN

NOTIFICATION LIST

New York State Police	(914) 343-1424
Superintendent-Hydro Maintenance Joseph B. Case	Office: (914) 856-2109 Home: (914) 754-8271
Manager-Electric Production Frank J. Kiernan	Office: (914) 352-6000, X-441 Home: (914) 342-0521
Security Manager John F. Kragh	Office: (914) 352-6000, X-558 Home: (914) 496-4964
Corporate Communications John P. Murphy	Office: (914) 627-2473 Home: (914) 942-0246
Federal Energy Regulatory Commission New York Regional Engineer James Hebson	Office: (212) 264-3687 Home: (201) 998-2845
Chief Civil Engineer (Alternate) Martin Inwald	Office: (212) 264-3687 Home: (516) 285-5964
Operations Duty Officer	(See Operations Duty Officer Schedule and Guidelines)

In answering this, please use the same subject
heading as on this letter

Subject Monitoring and Emergency Action Plan

To FILE

From B. Z. Baxter, Jr.

cc: Mr. F. E. Fischer
 Mr. J. Kragh
 Mr. K. B. Field

July 14, 1978

On July 7, 1978 a meeting was held at the New York State Police Headquarters, Troop F, in Middletown, New York to review our June 30, 1978 submittal of subject plan to the Federal Energy Regulatory Commission. Attendees were J. Kragh (O&R), B. Z. Baxter, Jr. (O&R), B. Muthig, Capt. (NYS Police) and J. McMahon, Lt. (NYS Police).

Since we had forwarded a copy of the plan to the NYS Police prior to the meeting, only a short discussion as to the purpose of the plan and the function of the State Police was required. We advised that they were the only group being asked to coordinate this Emergency Action Plan in the event implementation was necessary and we would forward them a list of residences not controlled by O&R that would be affected in the Mongaup Village area. The State Police felt that since there were few residences involved, notification would not be difficult.

They were informed that any changes in the Emergency Action Plan would be forwarded to them as they occurred.

The meeting was highly productive since we will be able to obtain their cooperation.

BZBjr/ct

B. Z. Baxter, Jr.
B. Z. Baxter, Jr.

914-627-2609

July 17, 1978

Blake Muthig, Captain
New York State Police
Troop F
Middletown, New York 10940

Subject: Monitoring and Emergency Action Plan
Mongaup River Hydroelectric Facilities

Dear Captain Muthig:

As agreed during our July 7, 1978 meeting, attached is a list of residences in the Mongaup Village area not controlled by Orange and Rockland which could be flooded due to upstream dam failure. We also attach a drawing showing location of the homes with respect to the expected area of flooding.

In the event of any changes in the Emergency Action Plan, you will be promptly notified.

Very truly yours,

BZBjr/ct
Atts.

B. Z. Baxter, Jr.
B. Z. Baxter, Jr.
Assistant Vice President

cc: Mr. J. Kragh

bcc: Mr. F. E. Fischer
Mr. K. B. Field

Mongaup Village Residences

Not Controlled By O&R

Donald A. Gregory 856-8324

Tri State Diesel
McKerrill's Garage 856-6646

Gilson No Phone Listed

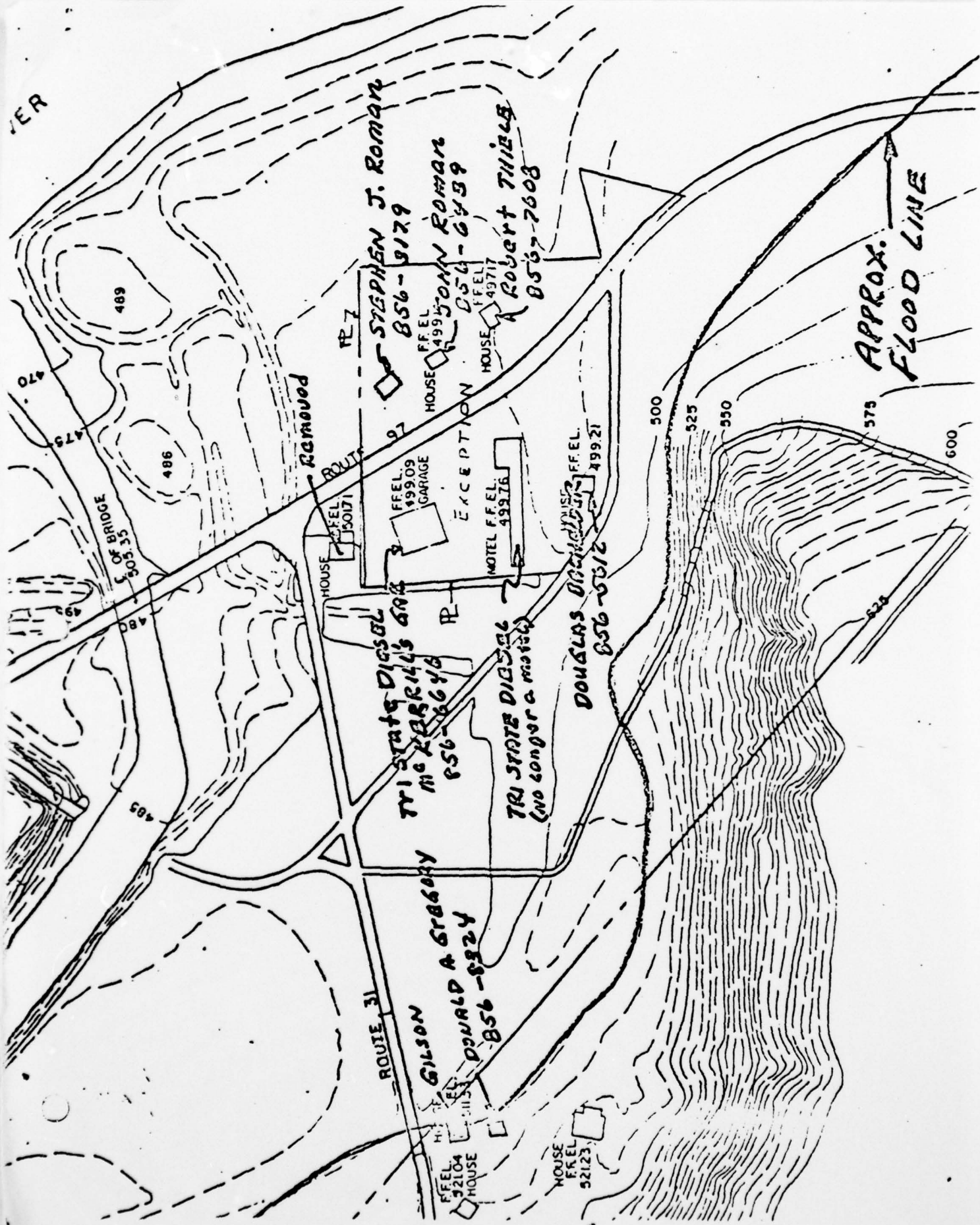
Douglas Bachelder 856-5612

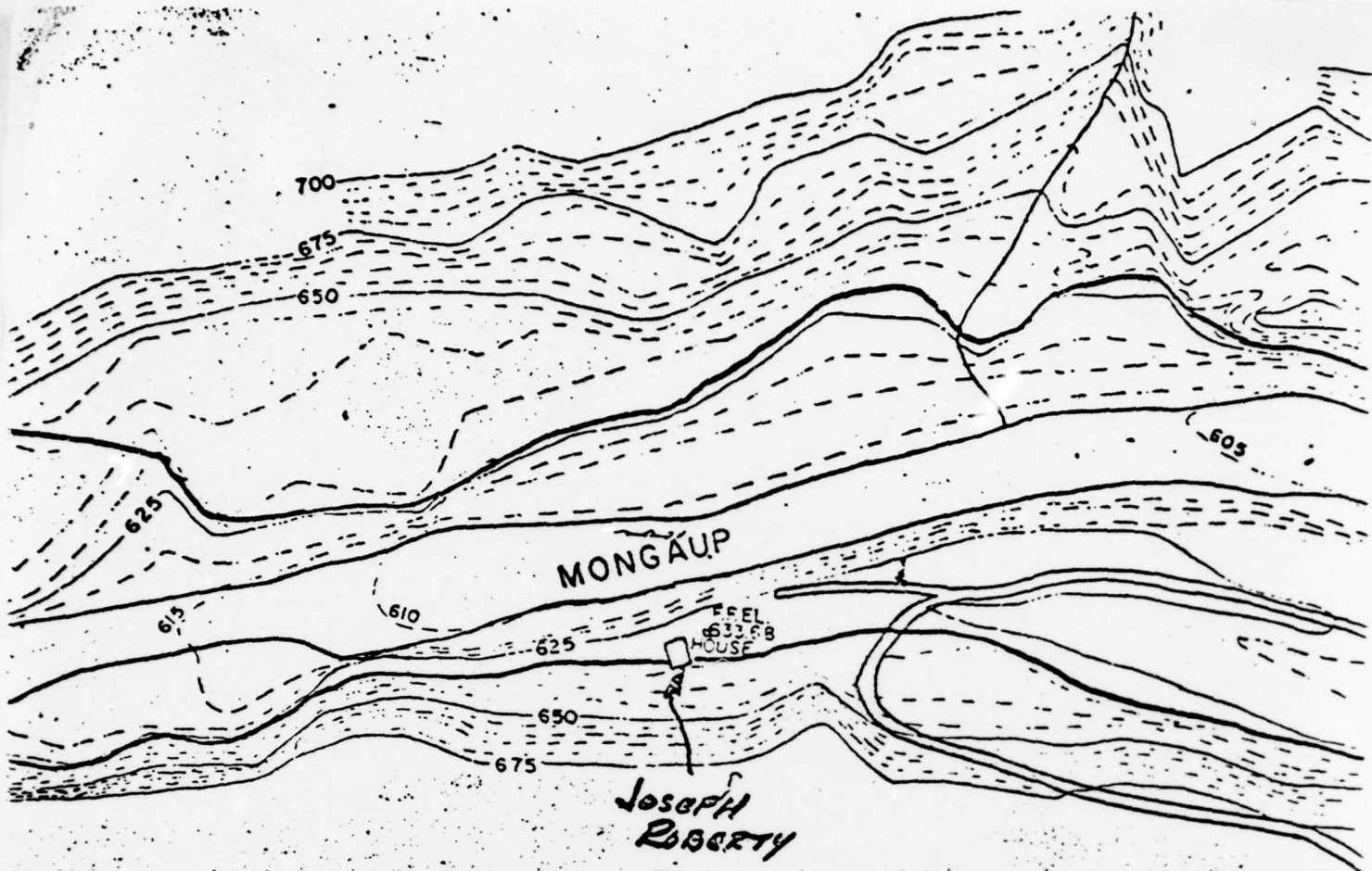
Stephen J. Roman 856-3179

John Roman 856-6439

Robert Thiele 856-7608

Joseph Roberty 856-5685





JOSEPH
ROBERTY
2
852-5285

TO RIO DAM RD.

COMPANY OPERATIONS
DUTY OFFICER
GENERAL GUIDELINES

PURPOSE

To provide for the availability of a person of sufficient rank to act in the capacity of Company spokesman and provide high level management direction, if required in the event of an incident or accident within the Company which would have a significant impact in terms of our customers, the general public, regulatory agencies, news media and other interested publics. This is consistent with our Company Policy of providing continuous service to our customers in a safe and efficient manner.

To provide an equitable distribution of Operating Department responsibilities during those periods outside of the normal business hours.

To provide the opportunity for the exposure of the Duty Officer to all facets of operations, thereby developing understanding, appreciation and flexibility of personnel within the Company.

GENERAL GUIDELINES

1. Copies of the Duty Officer Schedule for Company operations will be made available to the Service Operator Supervisor and Service Operators to facilitate contacting the appropriate person when an incident or accident occurs which may have a significant impact on the Company.
2. Persons scheduled for duty may change with other parties on the Duty Officer Schedule and will be obligated to inform the Service Operator Supervisor of such change.
3. The availability of the Duty Officer will be required during the entire week that the person is scheduled. Availability is not construed to mean that the person must stay at home by the telephone. However, it does mean that the person may be contacted in a timely fashion.
4. The person designated as Duty Officer for the week will act as the Company spokesman concerning any incident or accident that occurs during that week, until such time as another appropriate individual becomes available to act as the Company spokesman.
5. The availability of a Duty Officer will not supersede or change established procedures for emergency notification of functionally responsible Officers or other personnel.

GENERAL GUIDELINES - (Continued)

6. The Duty Officer shall act as the liaison authority across all departments, such as Transportation, Stores, etc. during the period outside of normal business hours. Problems which may develop after the standard Operating Procedures have been exhausted at lower levels of management, concerning the coordination of support services will be resolved by the Duty Officer.
7. Included with the Duty Officer Schedule are Emergency Procedures that are to be followed either by the Standby Duty Supervisor and/or persons within the operating departments in compliance with established requirements. It shall be the responsibility of the Duty Officer to ensure that these requirements are accomplished in a timely manner.

List of Drawings
Mongaup Falls

<u>DESCRIPTION</u>	<u>DRAWING NO.</u>
General Arrangement	374-4-A
Gate House	374-28
Gate House	374-29
Retaining Wall Section	374-34

EL 935

Gate House

New Road

Proposed EL 942

EL 930

Max. Flood

874

1 2 3 4 5 6

785
740

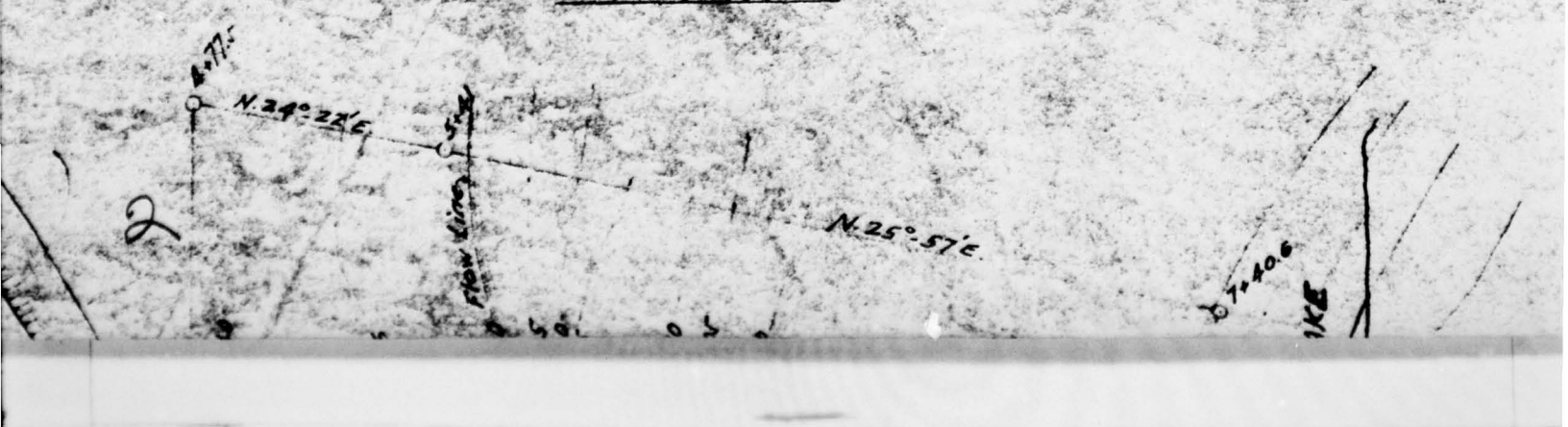
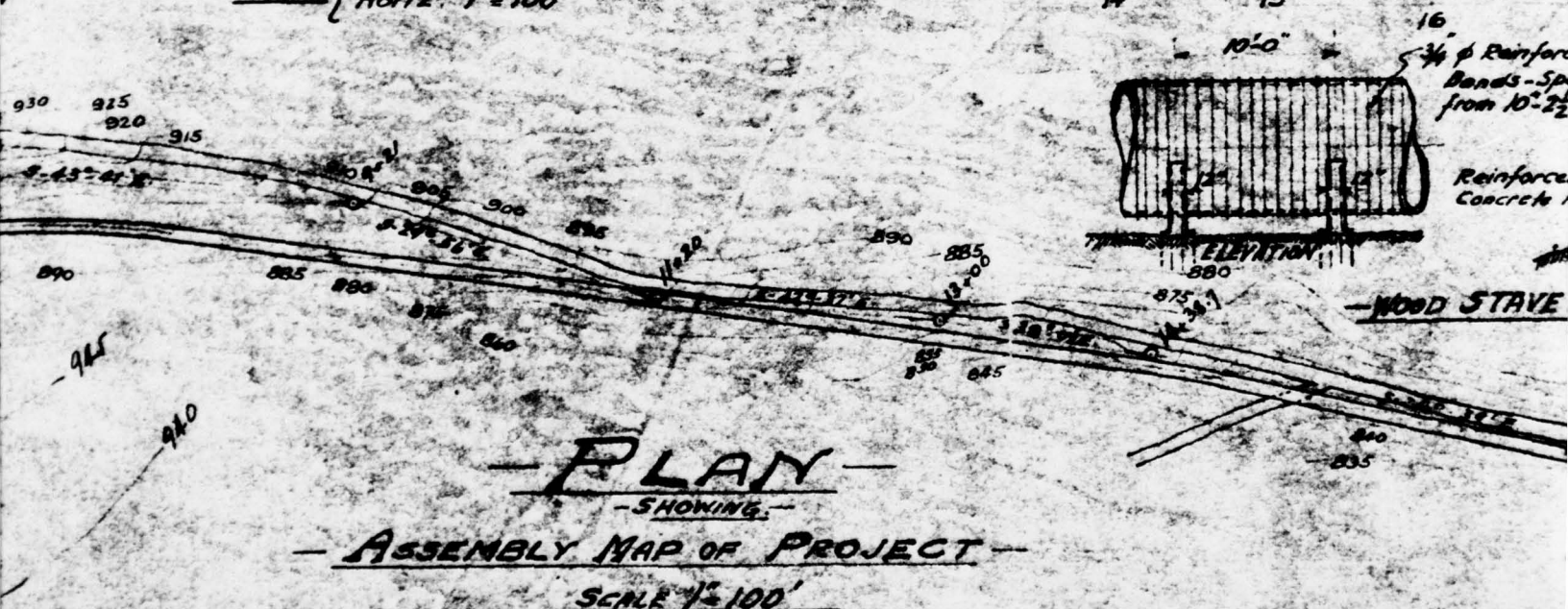
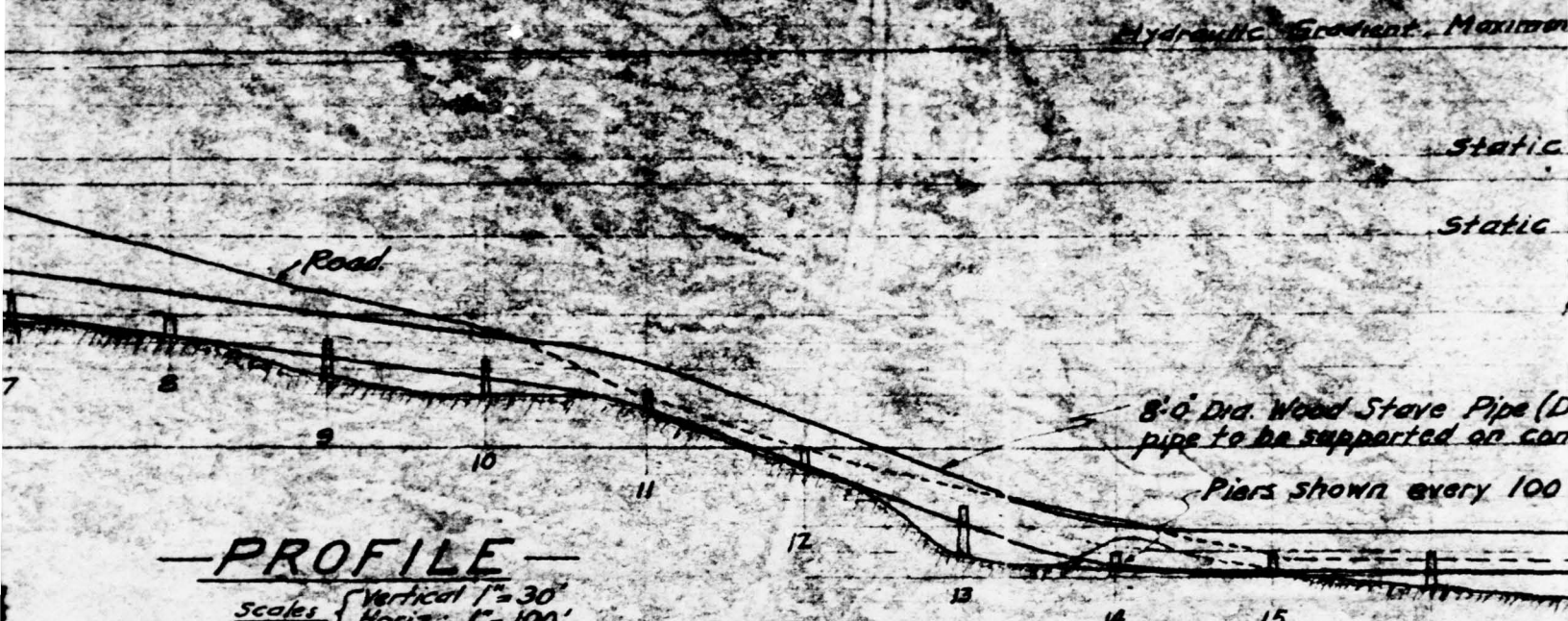
RIVER

DAM SITE

835

895

820
780
740
700
660
620
580
540
500
460
420
380
340
300
260
220
180
140
100
60
20



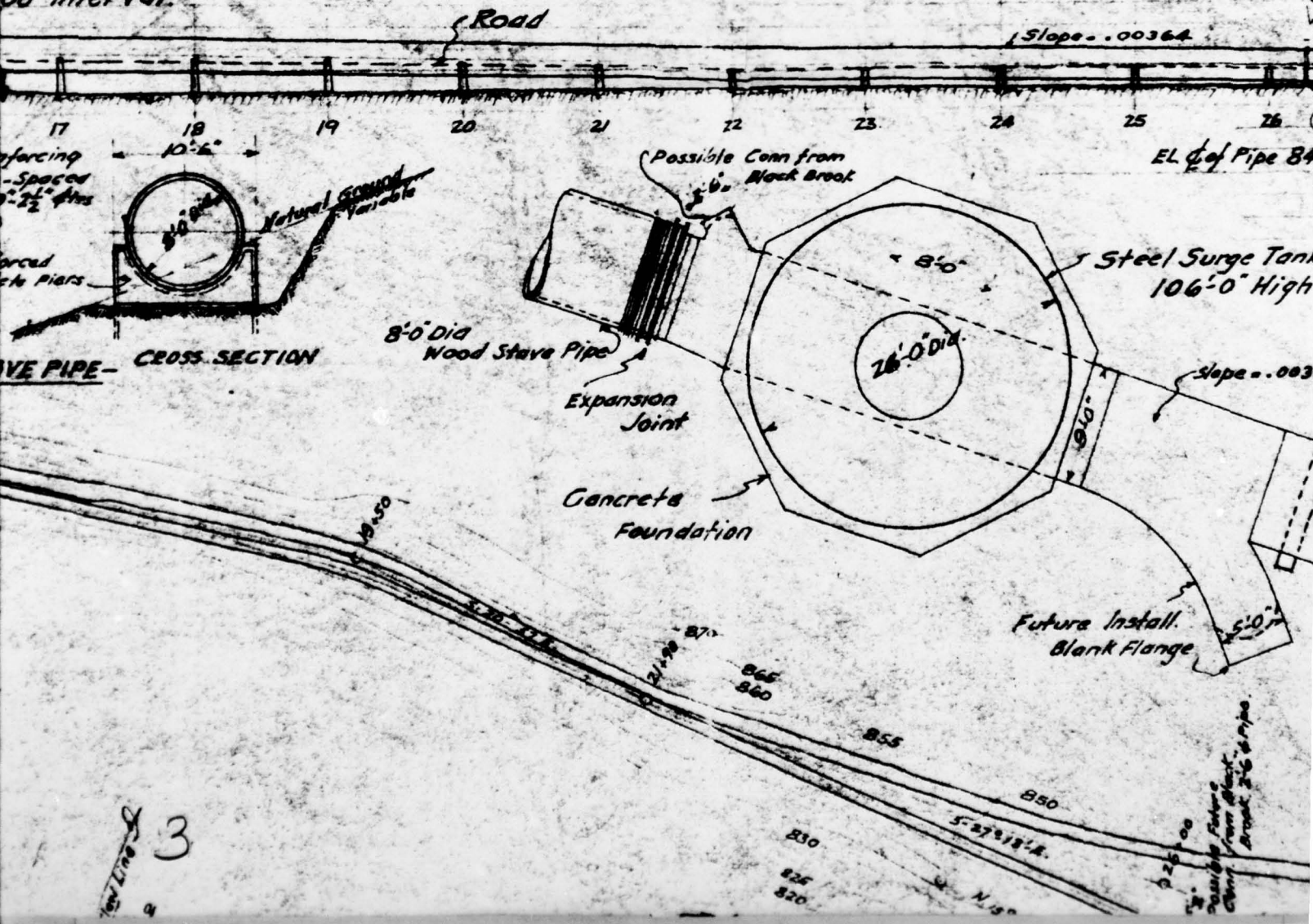
from Surge due to throwing off 3000 K.W.

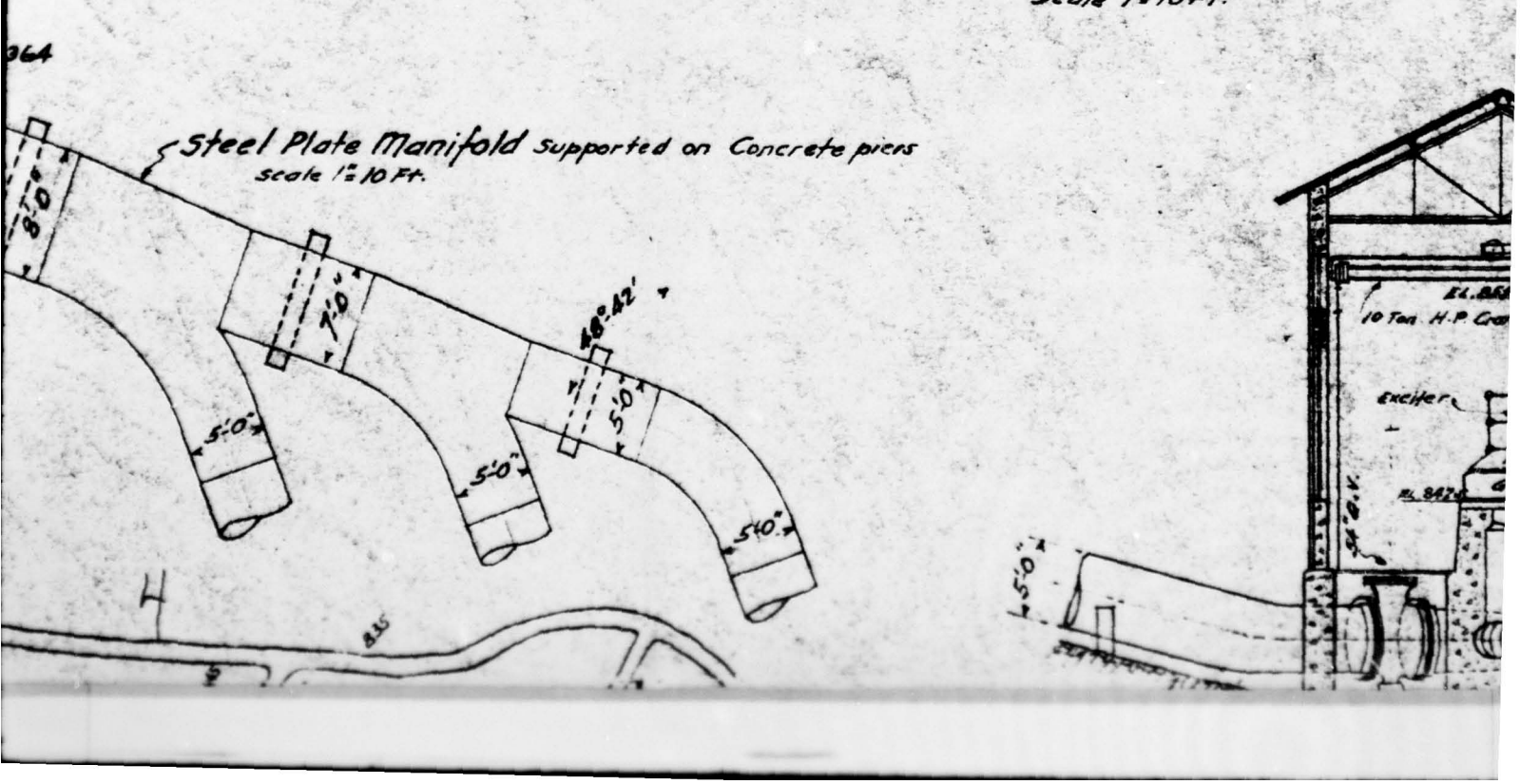
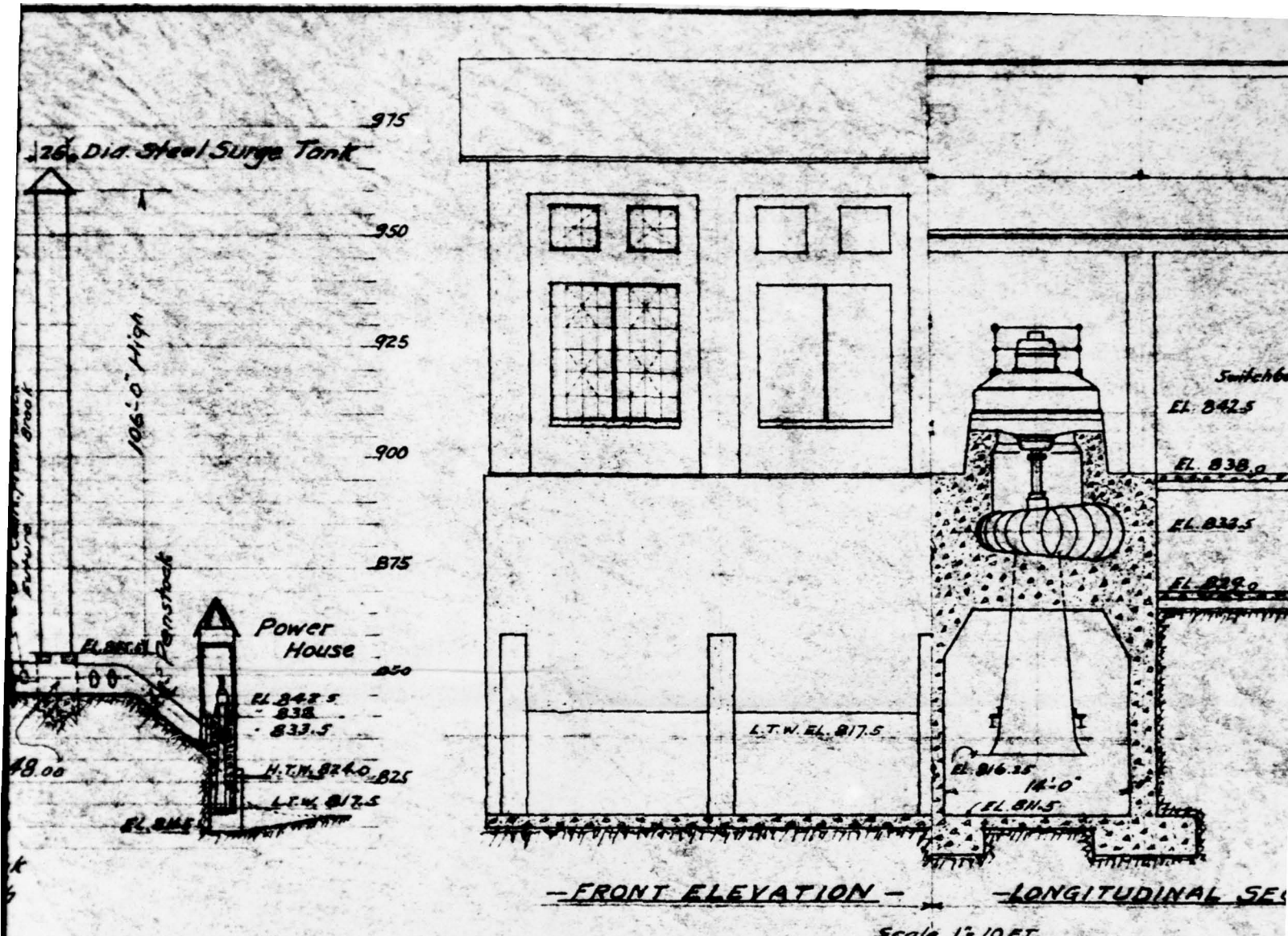
i.c. Level

i.c. Level

(Douglas Fir), $3\frac{1}{2}$ " Staves, reinforced with $\frac{3}{4}$ " ϕ steel bands, spaced from 10" to 2 $\frac{1}{2}$ " on ctrs.

100' interval.





AD-A077 482

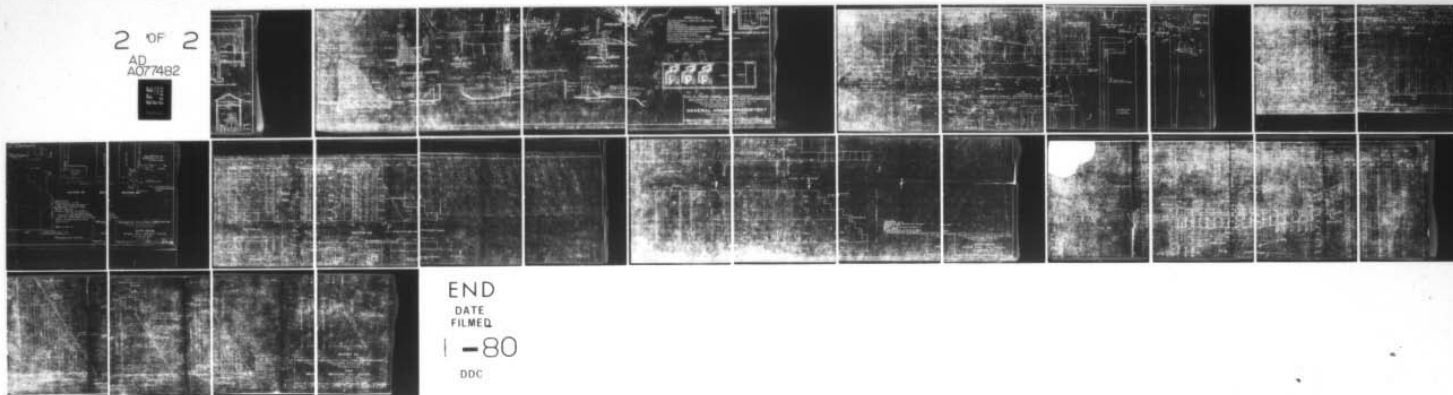
NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/6 13/13
NATIONAL DAM SAFETY PROGRAM. MONGAUP FALLS DAM (INVENTORY NUMBE--ETC(U)
SEP 79 6 KOCH DACW51-79-C-0001

UNCLASSIFIED

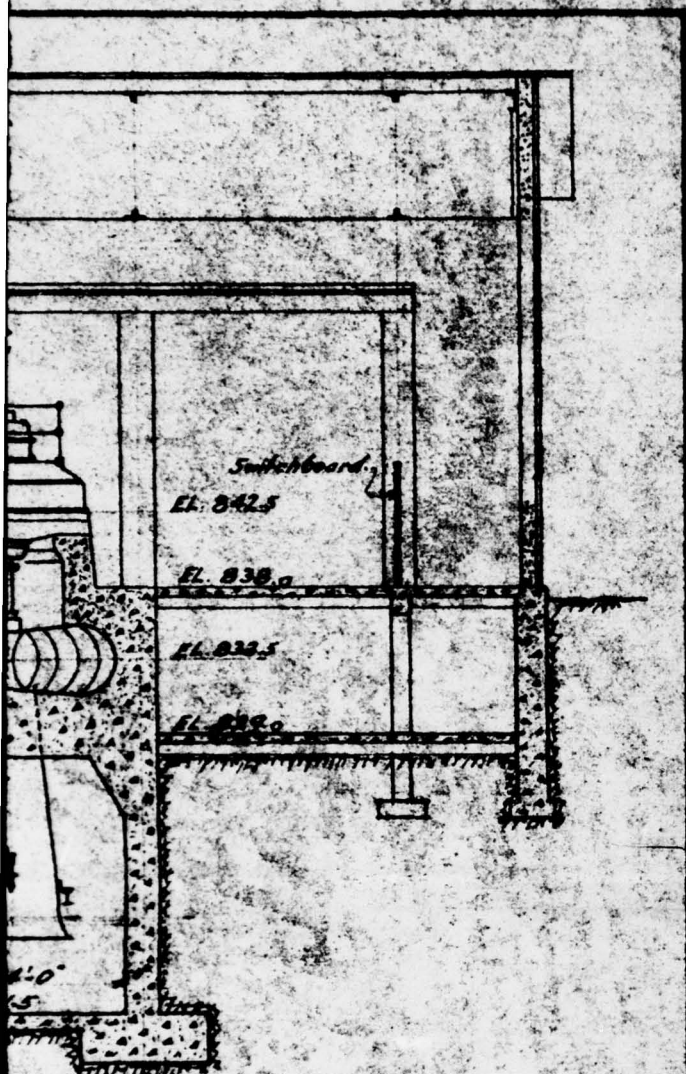
NL

2 OF 2

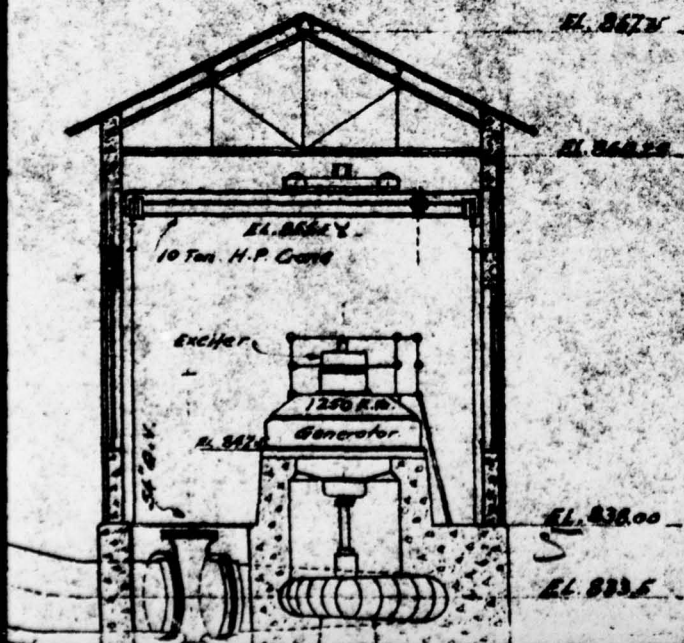
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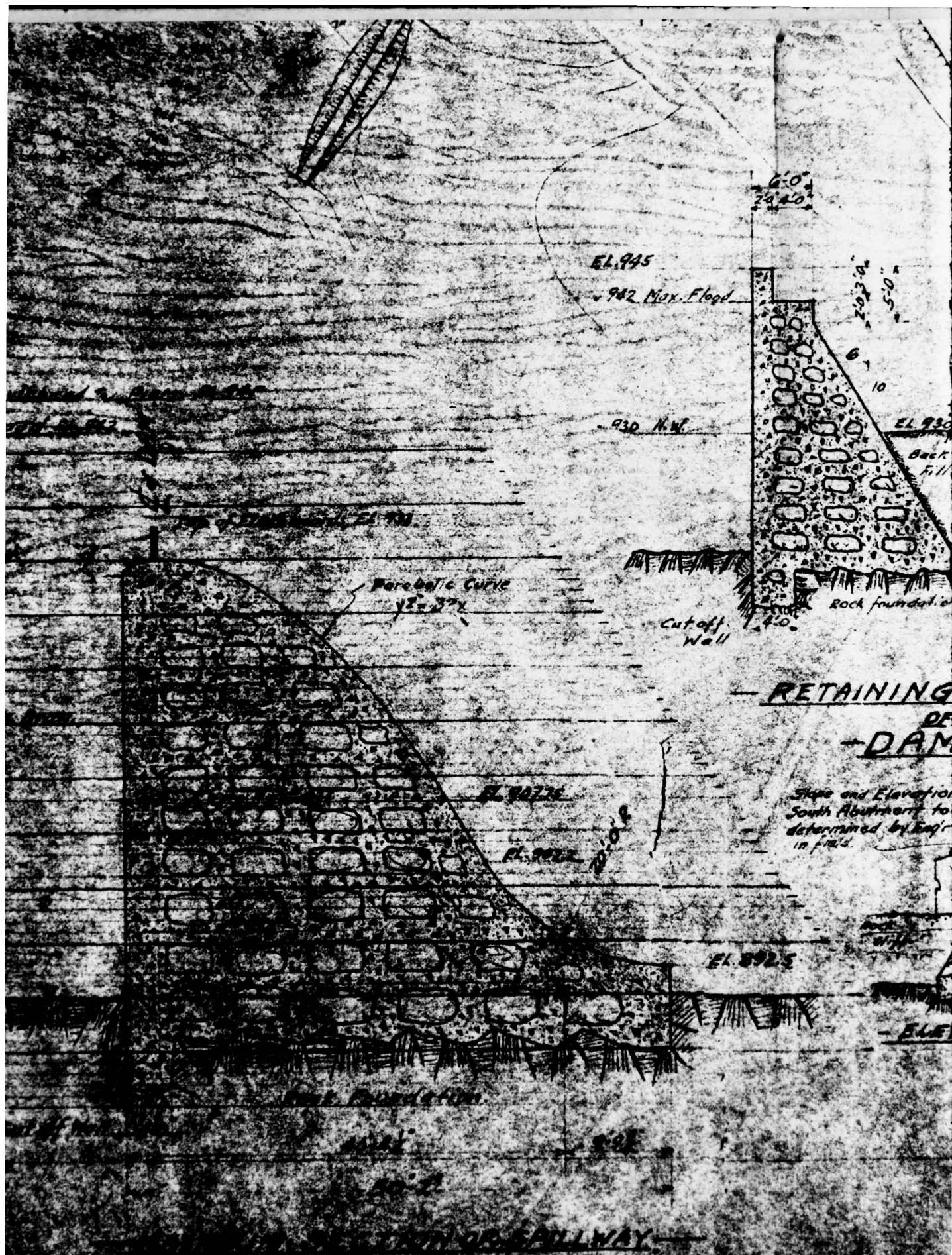


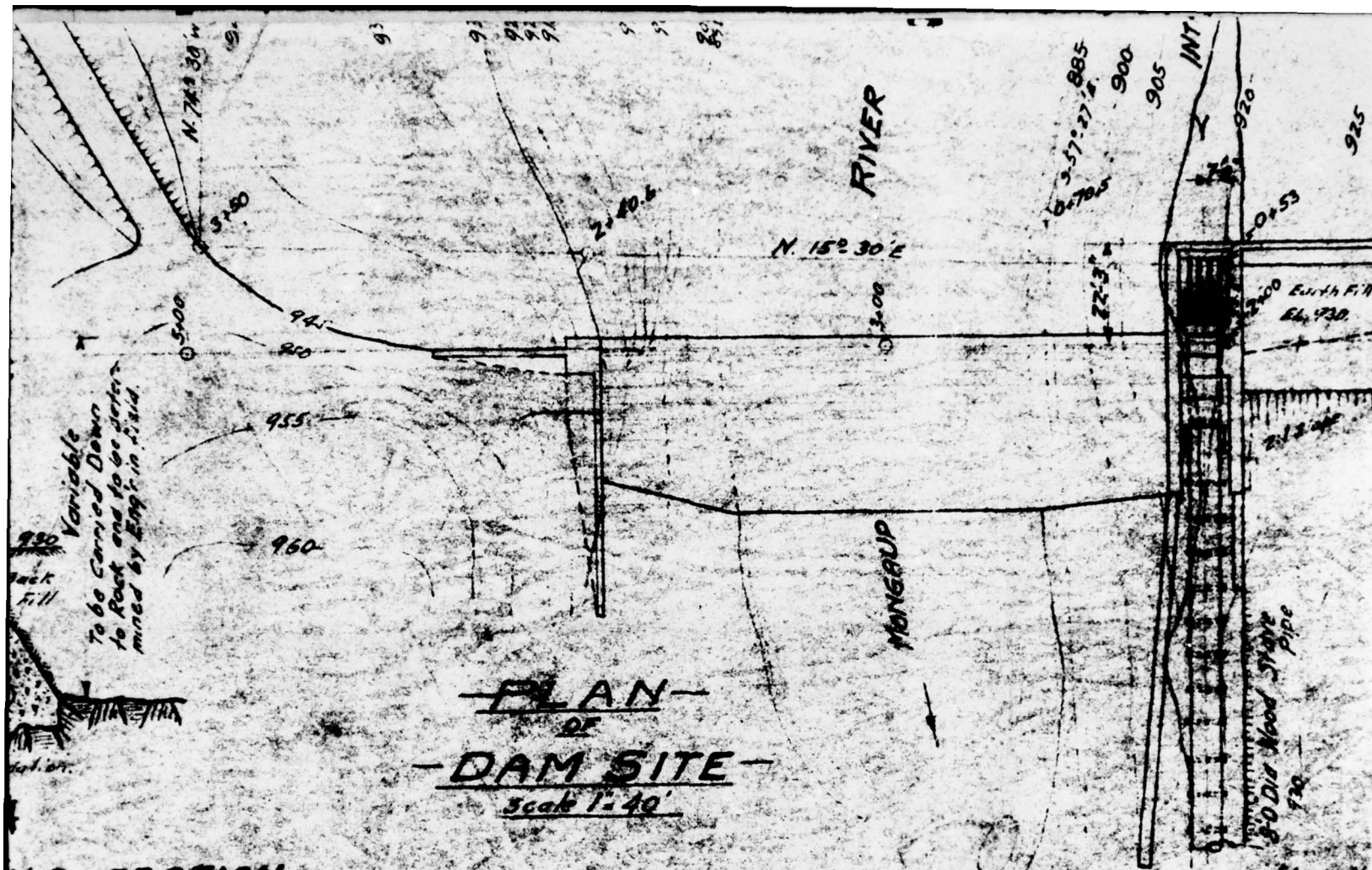
END
DATE
FILMED
1-80
DDC



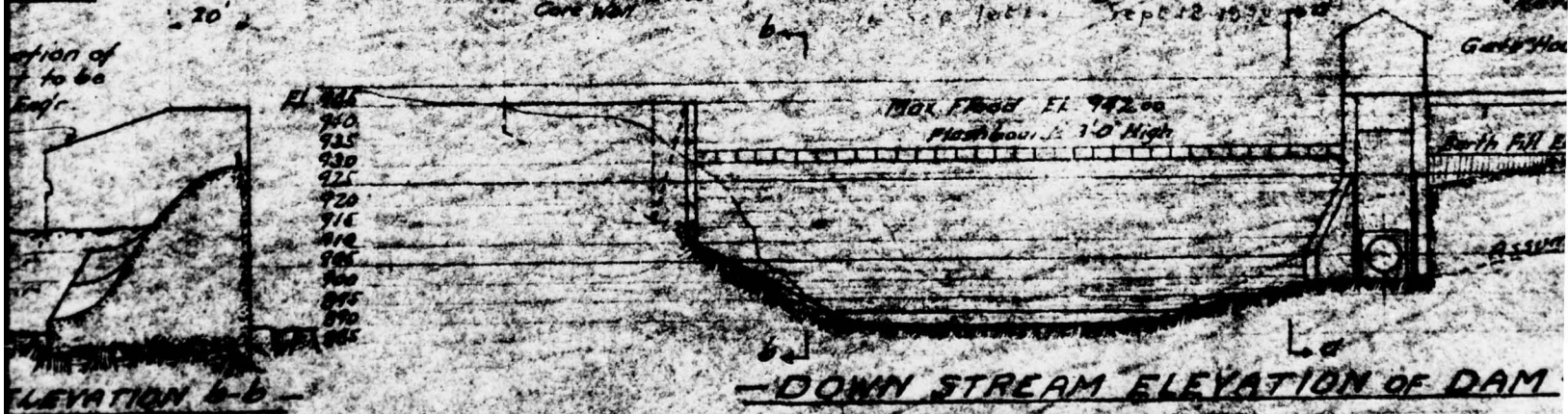
LONGITUDINAL SECTION-

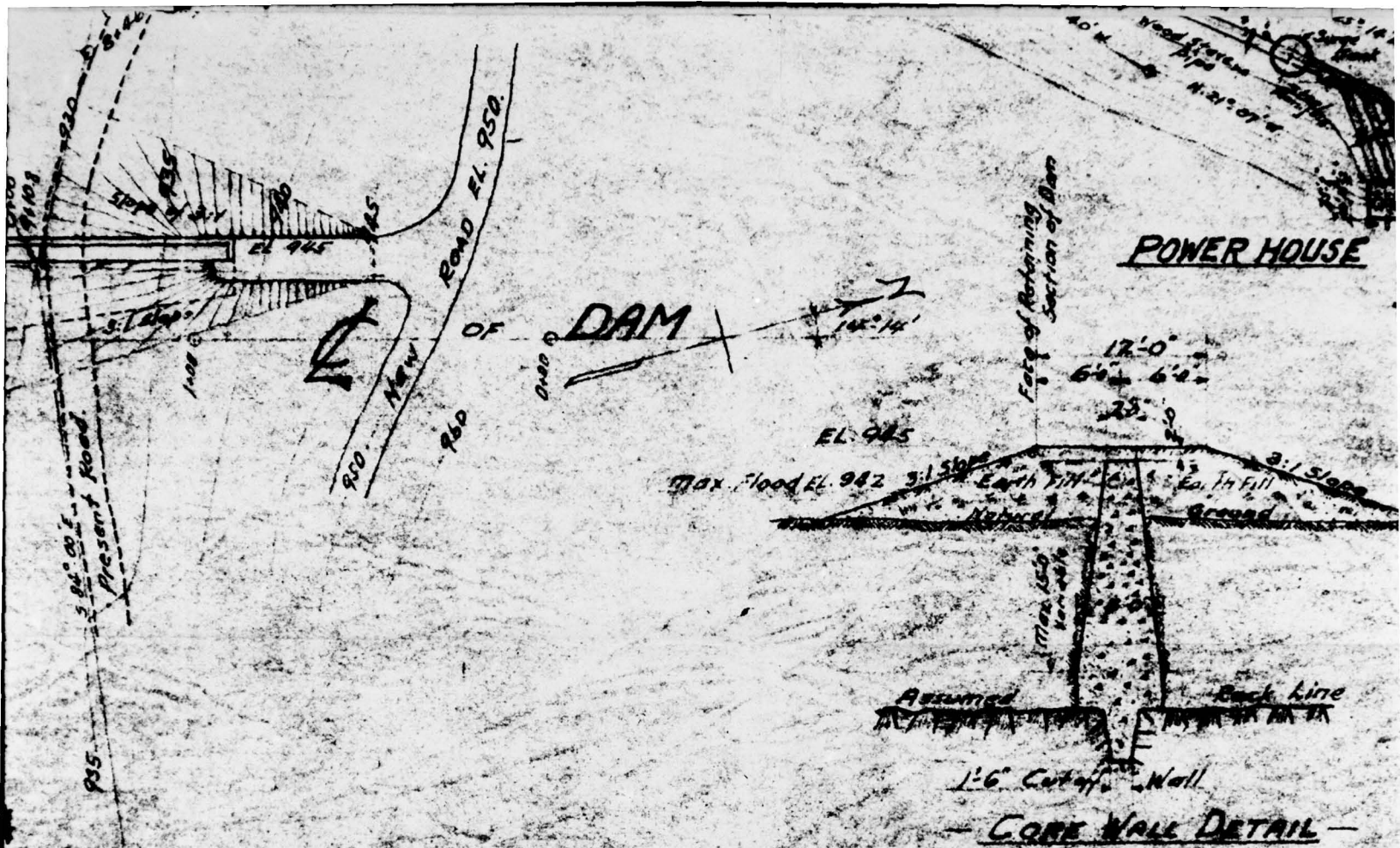






NG SECTION OF DAM





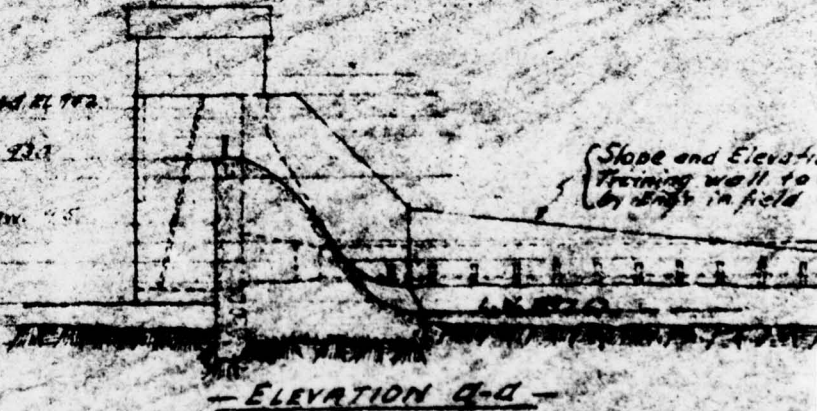
Height of Retaining Section of Dam to Core Wall
 determined by Engineer in field

100' s
 ing Section
 of Dam

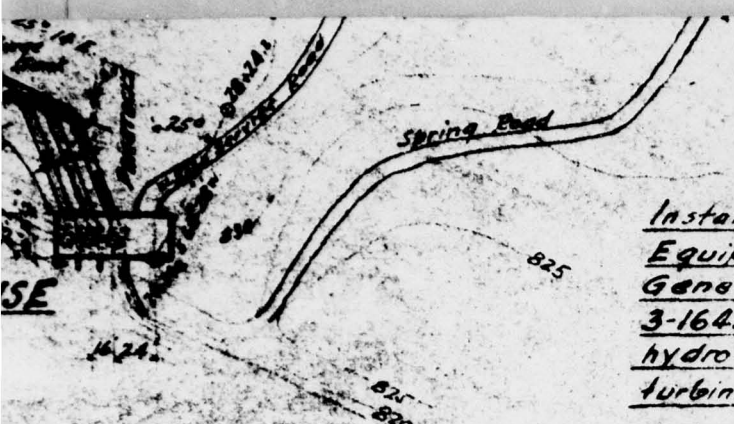
40' s
 Core Wall

Back line

EL 945
942
940
938
935
930
925
920
915
910
905
900
895
890
885



ELEVATION A-A



HEAD = 110 FT.

Installed Capacity = 4935 HP = 3750 K.V.A.

Equipment:-

Generating Units:

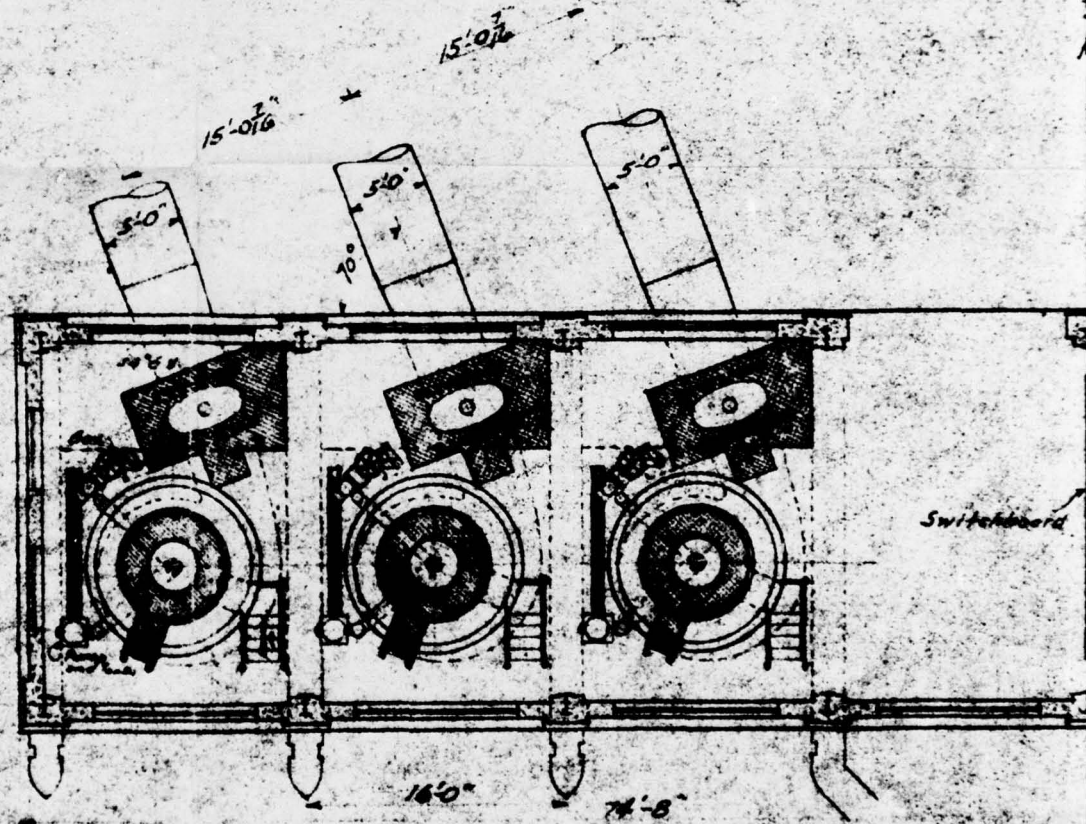
3-1645 HP-3750 K.Vo.-2300 V.-360 R.P.M. Vertical hydro-electric Units, plate steel spiral case turbines, thrust bearing on generator stator and direct connected exciters.

Transformers-3- 1250 K.V.A - 3 phase - 2300/33000

Arrangement: Switchboard and L.T. apparatus in Power House

H.T. apparatus in outdoor structure

CROSS SECTION



PLAN OF POWER HOUSE - scale

ATLANTIC UTILITIES

HYDRO-ELECTRIC DEVELOPMENT
MONGAUP RIVER, SULLIVAN
AT MONGAUP FALLS

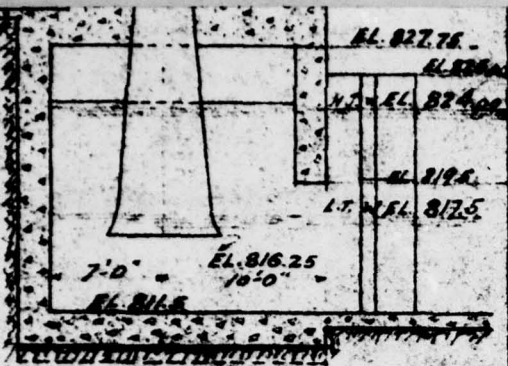
GENERAL ARRANGEMENT

R.R. LIVINGSTON, ENGINEER
25 RECTOR ST.
NEW YORK CITY

DRAWN BY	APPROVED	CHECKED
COMB	W.H.	CH

Elevation of wall to be determined in field

Falls



CROSS SECTION OF POWER HOUSE

House



15E - Scale 1" = 10 FT.

LITIES CORPORATION

DEVELOPMENT ON

R. SULLIVAN CO.

UP FALLS

ARRANGEMENT

STON, ENGR

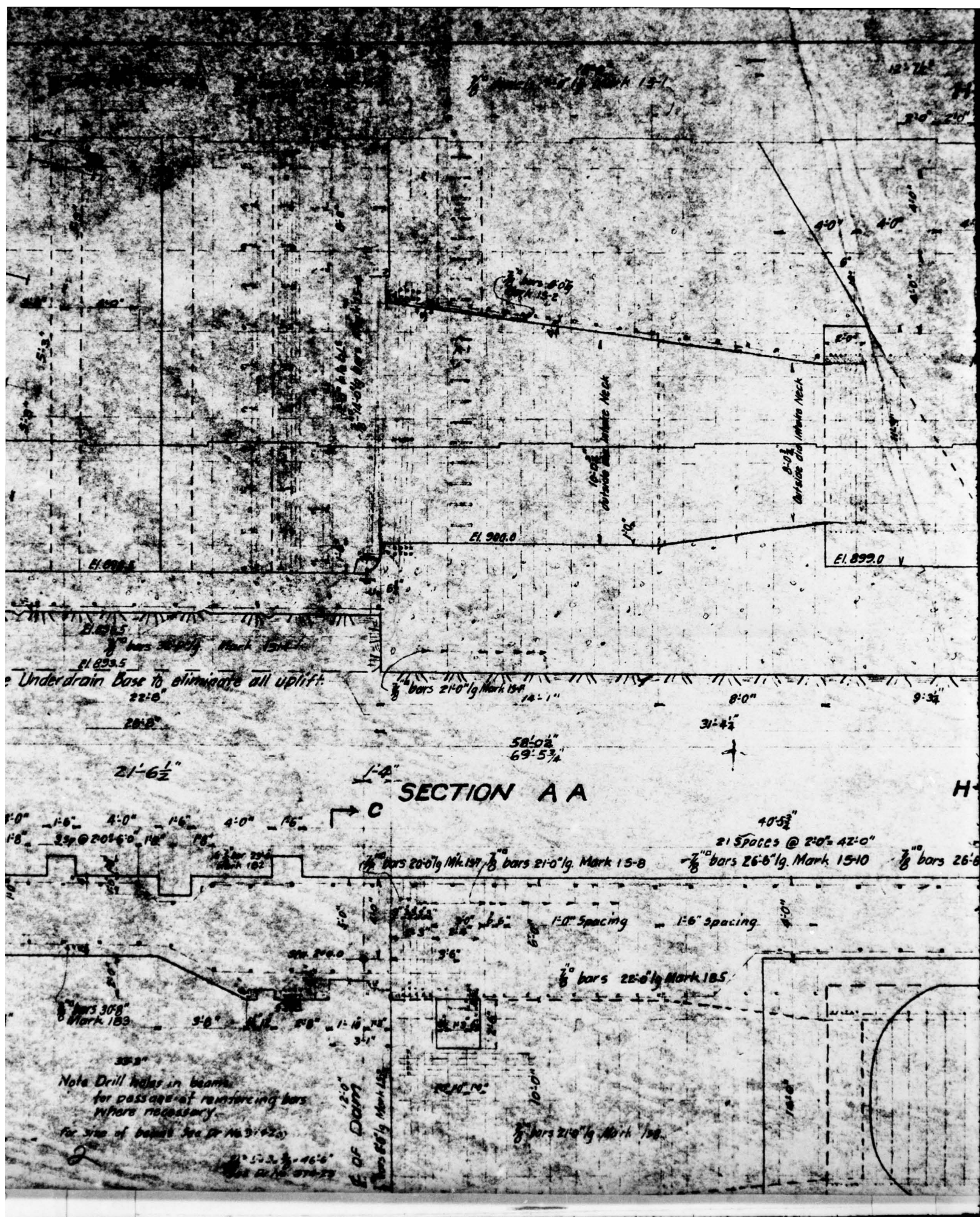
CTOR STR

YORK CITY

10

374-4A





Length and Slope of Training
Wall to be determined by
Engineer in Field

44 Ladder Rungs reqd.
Mark R-1

6x4x1/2 L
3/8" Anchors 9'-0"

SECTION

Note
For steel details
See Manufacturers Drawings

12'-0" between walls
11'-1" o. to o. 1/2" p/s.
10'-0" between walls

5/8" bars 23'-0" lg.
Mark 13-13

7/8" bars 17'-0" lg. Mark 13-5

Mark 13-10

5'-7"

10'-0"



3'-0"

2'-9"

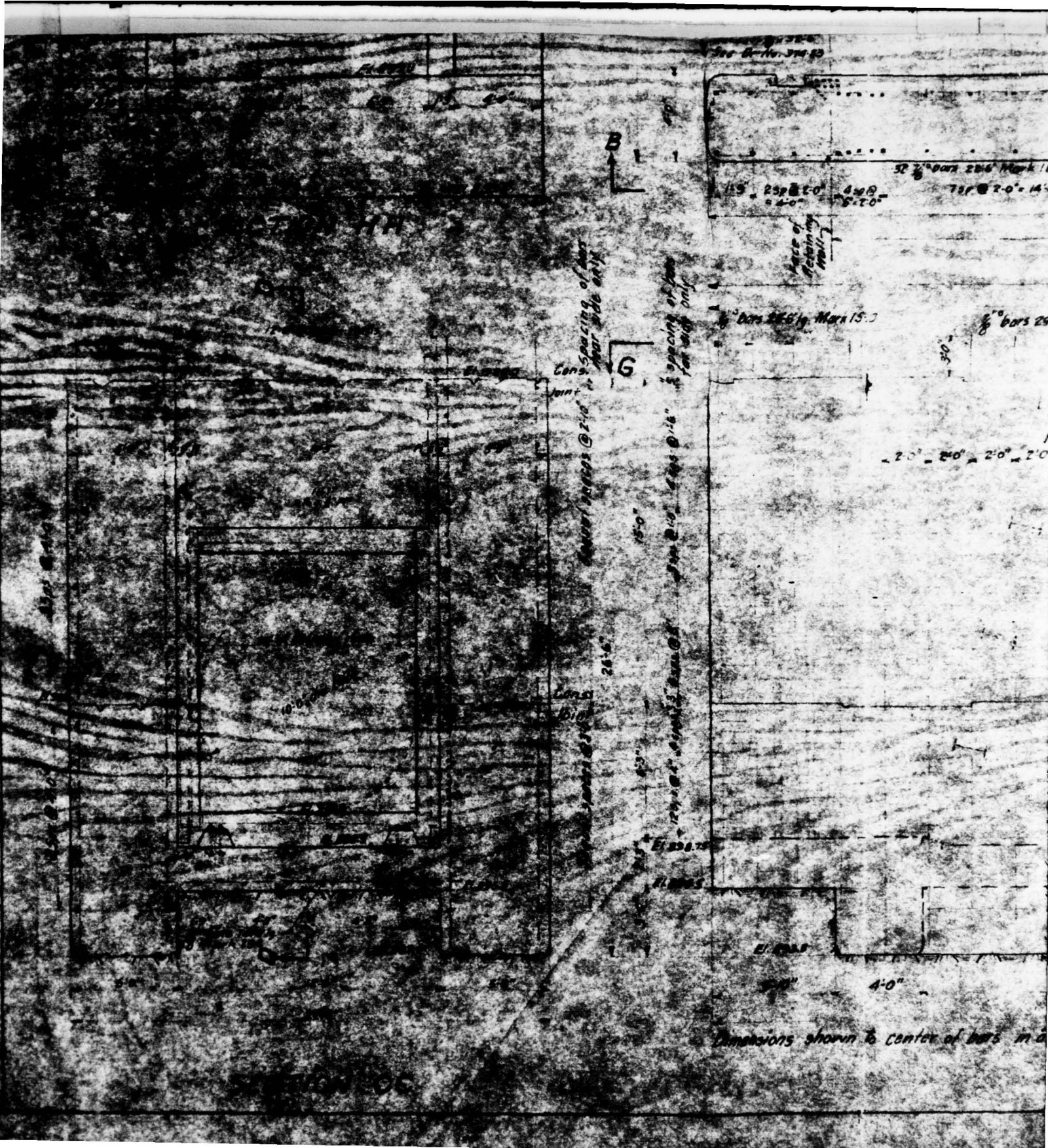
3



1'-0"

1'-10"

11'-1"
0.80 p/s
6'-6" = 5'-0"



bars 30-6 19 M.H. 100

$\frac{7}{8}^{\circ}$ bore 22:0" / 9 Mik. 185

1/8" bore 25-6" Mk 187

2nd Bars 13-0
 Mark 15-15
 Rio 432

PLAN GG

7th barst = o/g Mark 15-1

L c

51.3"

72:3"

29-5"lg. Mark 15-12

20' 20" 20"

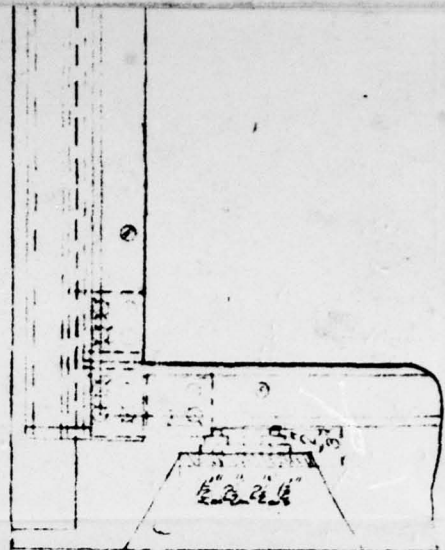
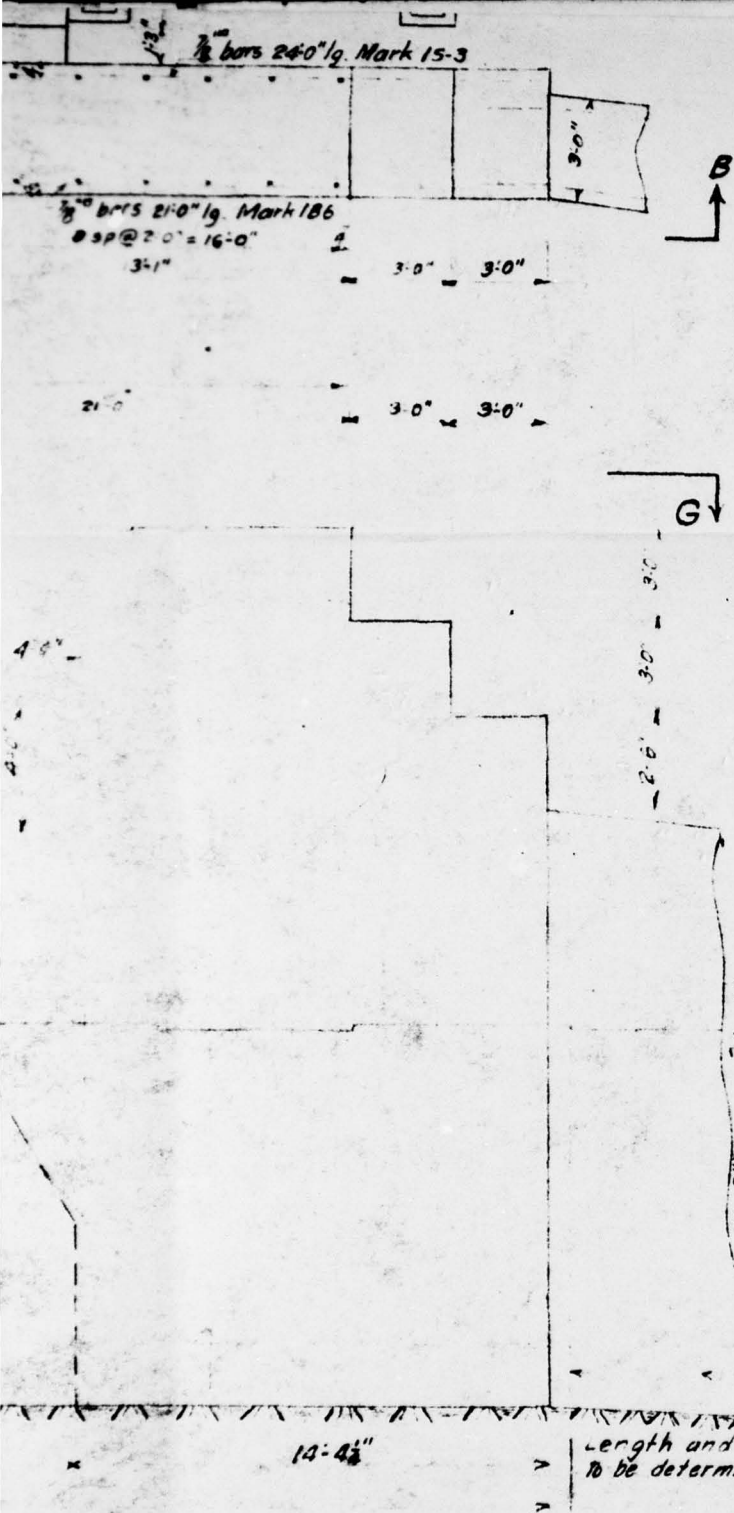
File # Dam

2-7 bar 25'6" lg Mark 15-10 for side only
54'-0"

78-3"

SECTION BB

6



of Roller Guides

SECTION FF

SECTION

General Notes

All concrete to be 1:3:5 Mix.
Integral Waterproofing requirements to be determined by Engineer in Field

Reference Drawings

For detail of Neck see Dr No. 374-21
" " " Pipe Piers see Dr No. 374-17
" Top Portion-Intake Pier see Dr No. 374-29
" details of reinforcing bars see Dr No. 374-30
For Intake Steel Details, Screens and Frames
See Dr No. 374-23

5/8" bars 17'-0" lg Mark 15-6

14'-4 1/2"

Length and slope of Training Wall
to be determined by Engineer in Field.

Revised Oct 30-22 Marking of bars revised
" NOV 15-22 Marking of bars revised

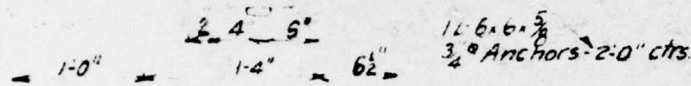
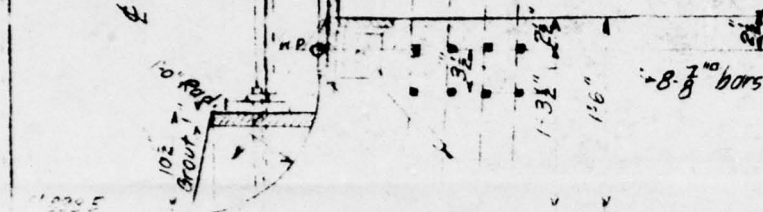
ATLANTIC
HYDRO

INTAKE

DRAWN BY
A.C.S.

4 of Roller Guides

Material $4 \times \frac{3}{4}$ " Bolts 1-3 1/4"
for 2 Piers { 2-Base Pl 6x1x8"
2-Washer 6x3/4x1-0"



SECTION DD

SCALE 1"=1'-0"

NOTE ALL STEEL TO BE IN PLACE BEFORE CONCRETE IS POURED.

ATLANTIC UTILITIES CORPORATION

HYDRO-ELECTRIC DEVELOPMENT ON
MONCAUP RIVER SULLIVAN CO.
AT MONCAUP FALLS

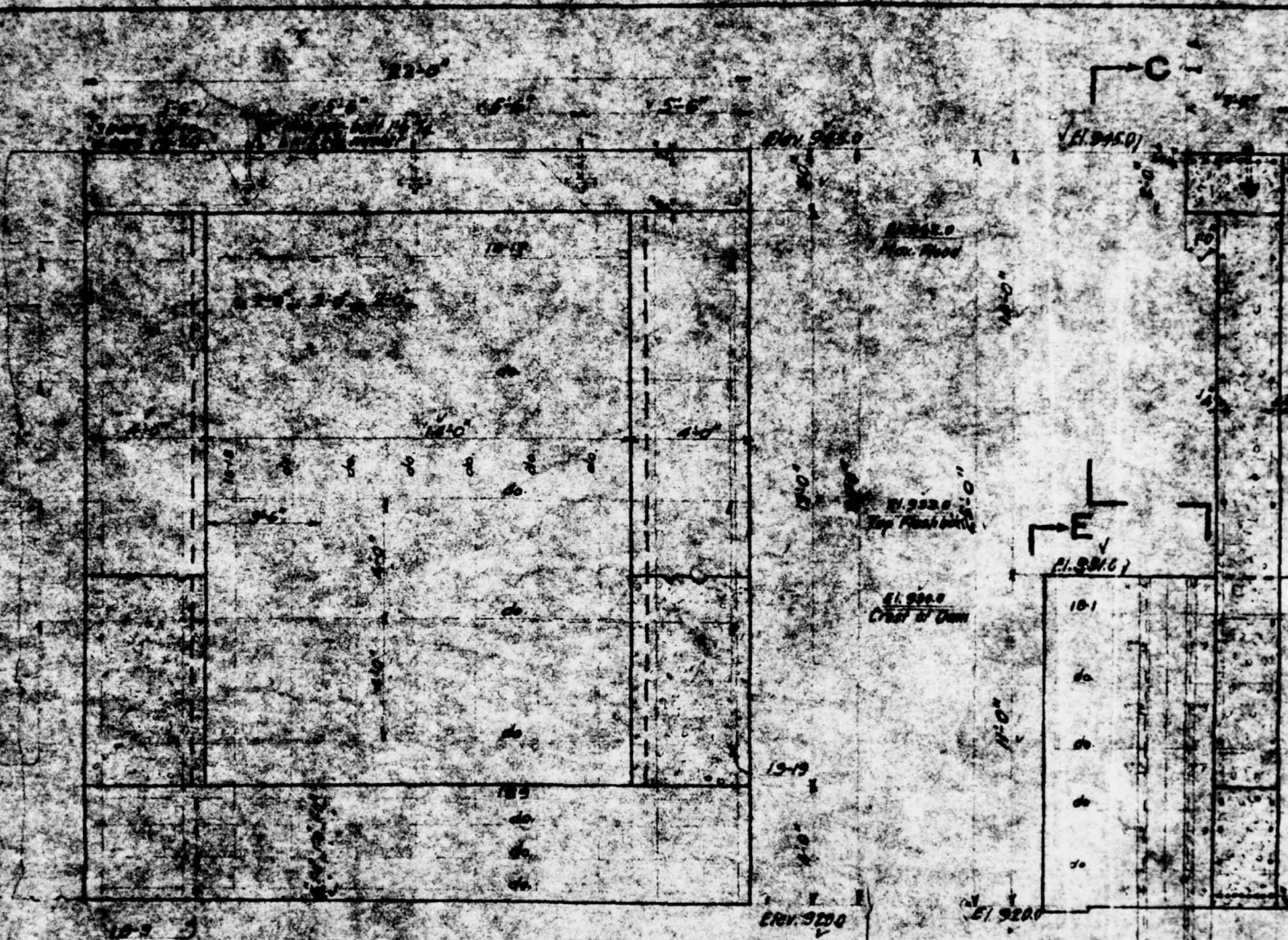
GATE HOUSE

INTAKE PIER - BOTTOM PORTION

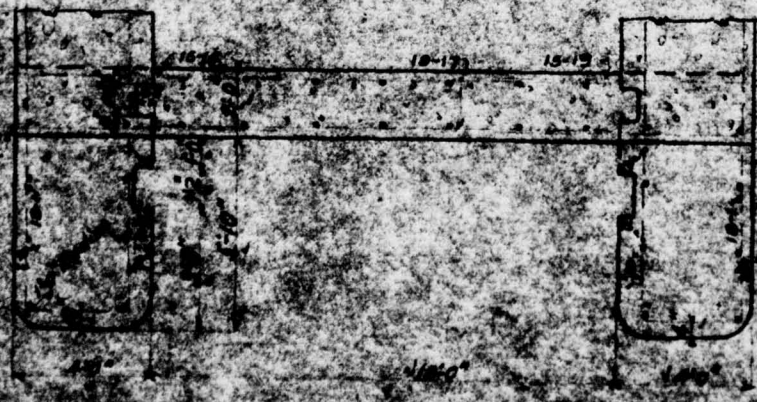
R. R. LIVINGSTON, ENGINEER
22 WEST 38
NEW YORK CITY

DRAWN BY	CHECKED BY	APPROVED BY	DATE
A. S.			11/1/30

374-28



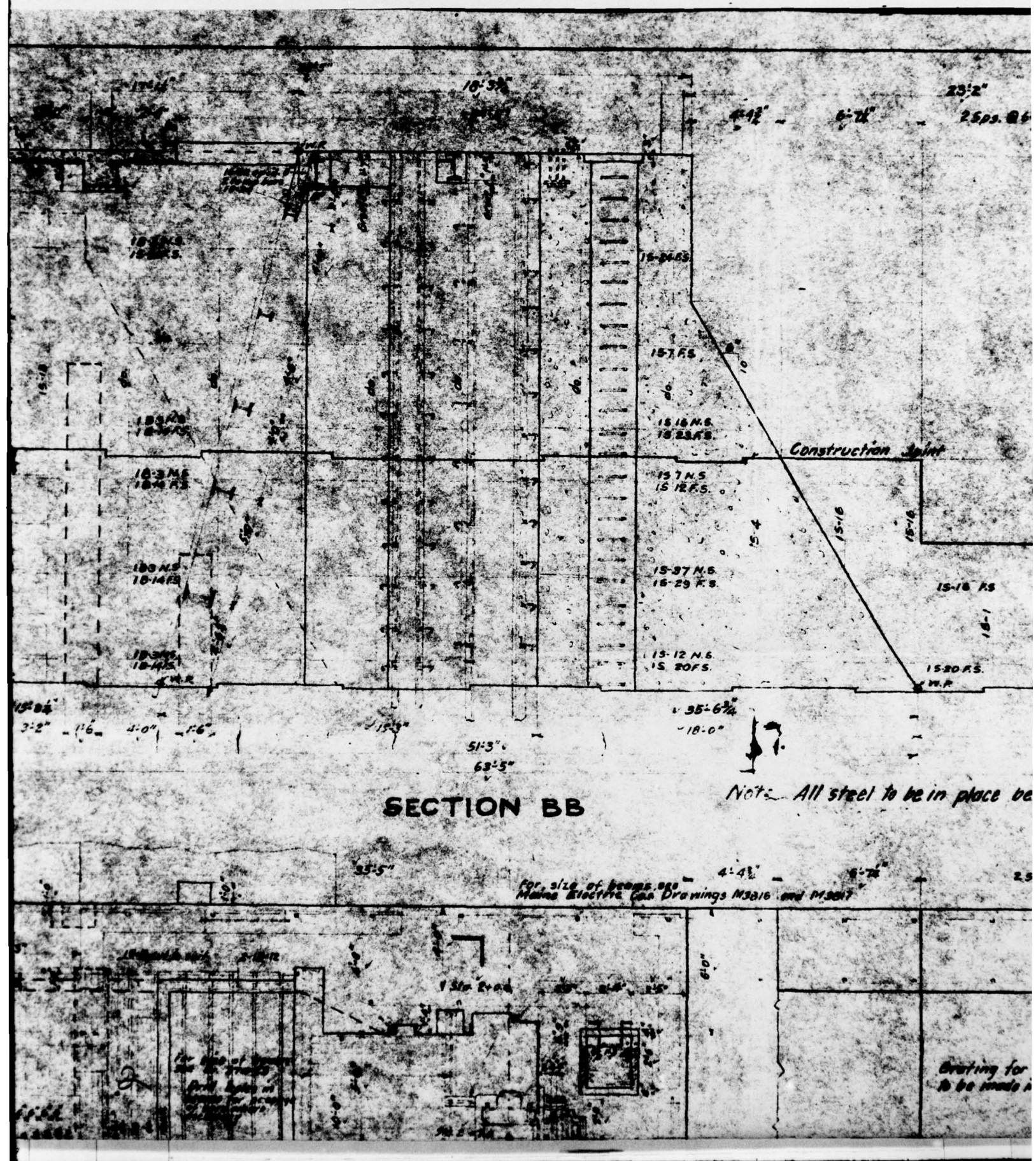
SECTION CC



PLAN DD



3'-0" cut & suit
2'-0" cut & suit



15-32

12-2"

12-2"

9 sps @ 6-1" = 12-2"

12-2"

before concrete is poured.

2.5 sps @ 6-1" = 12-2"

4-0"

for cover of ladder wall
do in field.

3



ELEVATION EE



Face of Retaining Wall

13-1/2" bolt 2'0"ig
N-6-3/4" washer

Elev. 2040

Elev. 2040

0.52

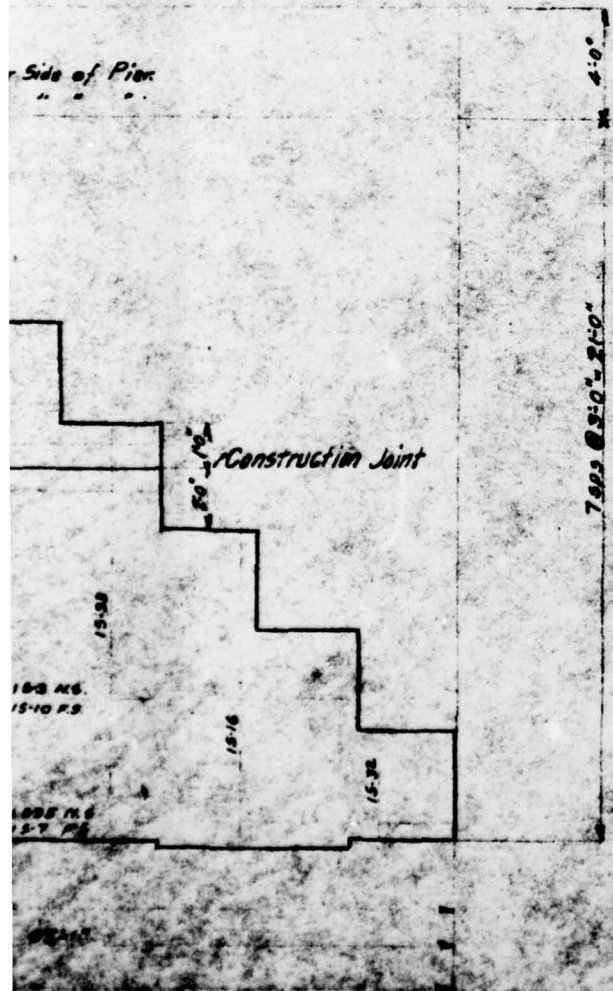
0.10

"14-5"

N.S. = Near S
F.S. = For



Side of Pier



General Notes.
 All concrete to be 1:3:6 Mix.
 Integral Waterproofing requirements to be determined
 by Engineer in field.
 Dimensions to c. of bars shown in all cases.
 Reference Drawings:
 For Bottom Pier - Bottom Portion See Dr. 374-2B
 Details of Reinforcing Bars - See Dr. 374-30
 Architectural Elevations of Gate House - see Dr. 374-4b

ATLAN
HYDR

INTA

DRAWN BY

terminated

L-28
0

see Dr. 374-46

ATLANTIC UTILITIES CORPORATION
HYDRO-ELECTRIC DEVELOPMENT ON
MONGAUP RIVER SULLIVAN CO.
AT MONGAUP FALLS

GATE HOUSE

INTAKE PIER: TOP PORTION

R. S. LIVINGSTON ENGR.
100 EASTON ST.
NEW YORK CITY

DESIGNED BY	ENGINEER	ARCHITECT	DATE
1916	1917	1917	374-29

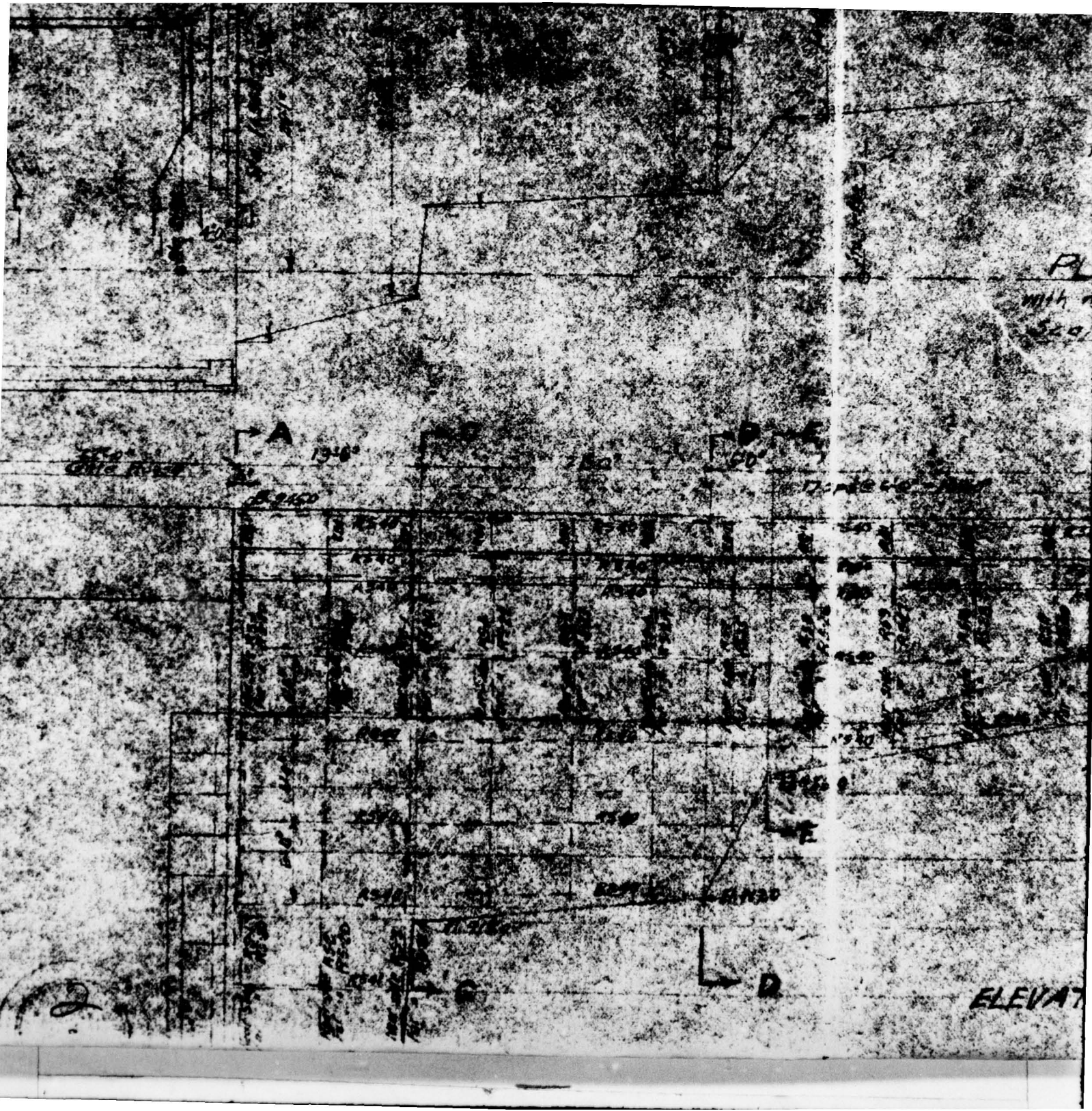
St. James

SECTION BB

B&O

5

7



Slope 2:1

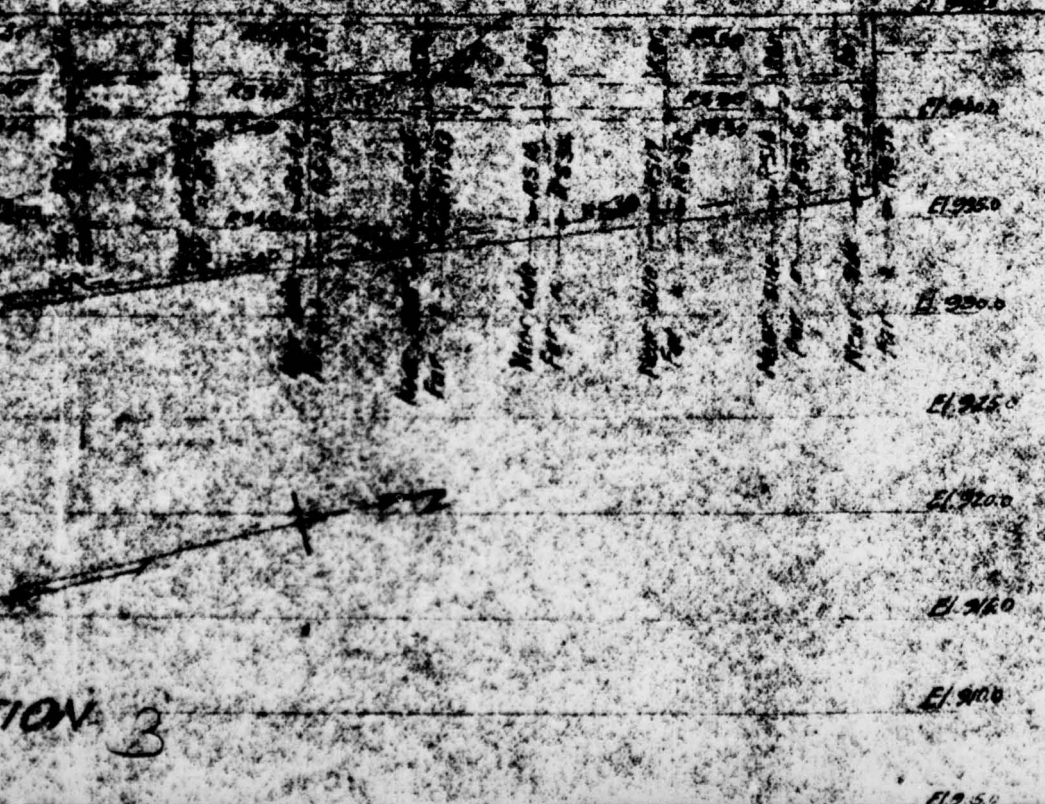
Elevation Top
of Embankment
Top of Cut off Wall
El. 945.0

Slope 3:1

Mark	No.
RB-1	20
RS-1	4
RS-2	1
RS-3	1
RS-4	1
RS-5	1
RS-6	1
RS-7	1
RS-8	1
RS-9	1
RS-10	1
RS-11	1
RS-12	1
RS-13	1
RS-14	1
RS-15	1
RS-16	1
RS-17	1
RS-18	1
RS-19	5
RS-20	1
RS-21	1
RS-22	1
RS-23	1
RS-24	1
RS-25	1
RS-26	1
RS-27	1
RS-28	1
RS-29	1
RS-30	1
RS-31	1
RS-32	1
RS-33	1
RS-34	1
RS-35	1
RS-36	1


SECTION FF

Area of
embankment
to be
filled



LIST OF REINFORCING BARS

Retaining Wall

Mark	No.	Size	Length	Diagram
RB-1	20	$\frac{7}{8}$ "	19'-0"	
RS-1	4	$\frac{7}{8}$ "	20'-5"	STRAIGHT
RS-2	1	$\frac{7}{8}$ "	26'-0"	STRAIGHT
RS-3	1	$\frac{7}{8}$ "	19'-3"	STRAIGHT
RS-4	1	$\frac{7}{8}$ "	28'-6"	STRAIGHT
RS-5	1	$\frac{7}{8}$ "	28'-0"	STRAIGHT
RS-6	1	$\frac{7}{8}$ "	27'-8"	STRAIGHT
RS-7	1	$\frac{7}{8}$ "	21'-6"	STRAIGHT
RS-8	1	$\frac{7}{8}$ "	19'-0"	STRAIGHT
RS-9	1	$\frac{7}{8}$ "	17'-6"	STRAIGHT
RS-10	1	$\frac{7}{8}$ "	17'-3"	STRAIGHT
RS-11	1	$\frac{7}{8}$ "	15'-5"	STRAIGHT
RS-12	1	$\frac{7}{8}$ "	15'-0"	STRAIGHT
RS-13	1	$\frac{7}{8}$ "	14'-0"	STRAIGHT
RS-14	1	$\frac{7}{8}$ "	13'-0"	STRAIGHT
RS-15	1	$\frac{7}{8}$ "	12'-4"	STRAIGHT
RS-16	1	$\frac{7}{8}$ "	11'-0"	STRAIGHT
RS-17	1	$\frac{7}{8}$ "	10'-6"	STRAIGHT
RS-18	1	$\frac{7}{8}$ "	9'-0"	STRAIGHT
RS-19	1	$\frac{7}{8}$ "	9'-0"	STRAIGHT
RS-20	5	$\frac{7}{8}$ "	8'-8"	STRAIGHT
RS-21	1	$\frac{7}{8}$ "	8'-0"	STRAIGHT
RS-22	1	$\frac{7}{8}$ "	7'-6"	STRAIGHT
RS-23	1	$\frac{7}{8}$ "	7'-0"	STRAIGHT
RS-24	1	$\frac{7}{8}$ "	6'-6"	STRAIGHT
RS-25	1	$\frac{7}{8}$ "	6'-0"	STRAIGHT
RS-26	1	$\frac{7}{8}$ "	5'-6"	STRAIGHT
RS-27	1	$\frac{7}{8}$ "	5'-0"	STRAIGHT
RS-28	1	$\frac{7}{8}$ "	4'-6"	STRAIGHT
RS-29	1	$\frac{7}{8}$ "	4'-0"	STRAIGHT
RS-30	1	$\frac{7}{8}$ "	3'-6"	STRAIGHT
RS-31	1	$\frac{7}{8}$ "	3'-0"	STRAIGHT
RS-32	1	$\frac{7}{8}$ "	2'-6"	STRAIGHT
RS-33	1	$\frac{7}{8}$ "	2'-0"	STRAIGHT
RS-34	1	$\frac{7}{8}$ "	1'-6"	STRAIGHT
RS-35	1	$\frac{7}{8}$ "	1'-0"	STRAIGHT
RS-36	1	$\frac{7}{8}$ "	1'-0"	STRAIGHT

See Elevation

El. 979.0

Back Fill

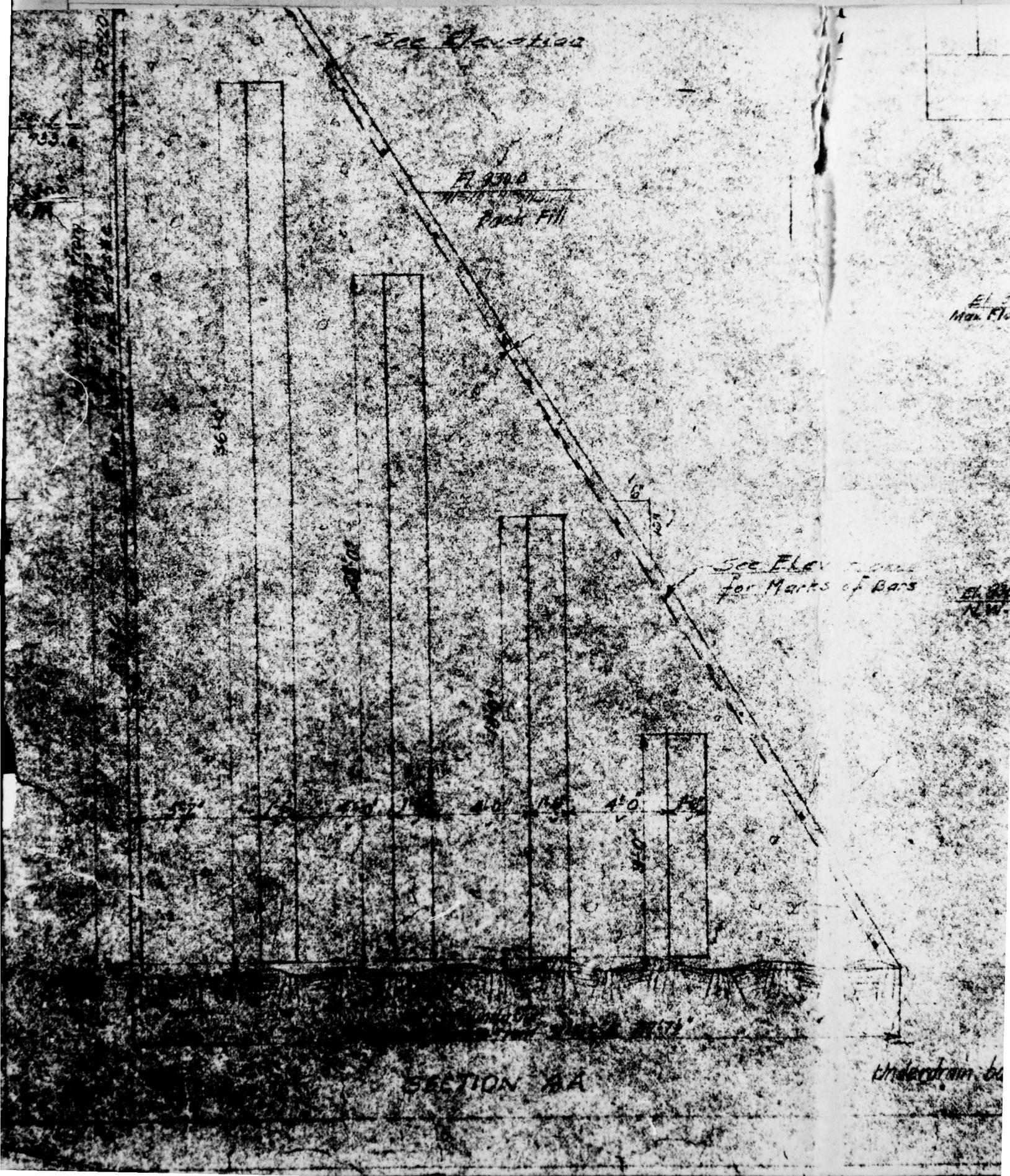
El. 979.0
Max. Flo.

See Elevation
for Marks of Bars

El. 979.0
N.W.

SECTION AA

Underdrain box



E1 398.0

E1 345.0

RB-1

E1 342.0

E1 345.0

All reinforcing bars -
Longitudinal bars to be
by Engineer in field

See Elevation
for details of bars

E1 330.0

Reinforcing bars
30.0' to 28.0'

Reinforcing bars
30.0' to 28.0'

Rock Foundation

The cross walls have been
base to eliminate depth

SECTION CC

15-38 2
 15-39 6
 15-40 8

112000

2-0

El. 9450

Permit No. 2-112000

General Notes:
 All work shall be 1:5 5 mix.
 Integral waterproofing requirements
 to be determined by Eng. in field.
 Dimensions shown to 1/2" unless in
 all cases.
 For details of 6th Re. in the Pier
 see Plan No. 374-28 and 374-29.

ATLANTIC
 HYDRO-
 MC

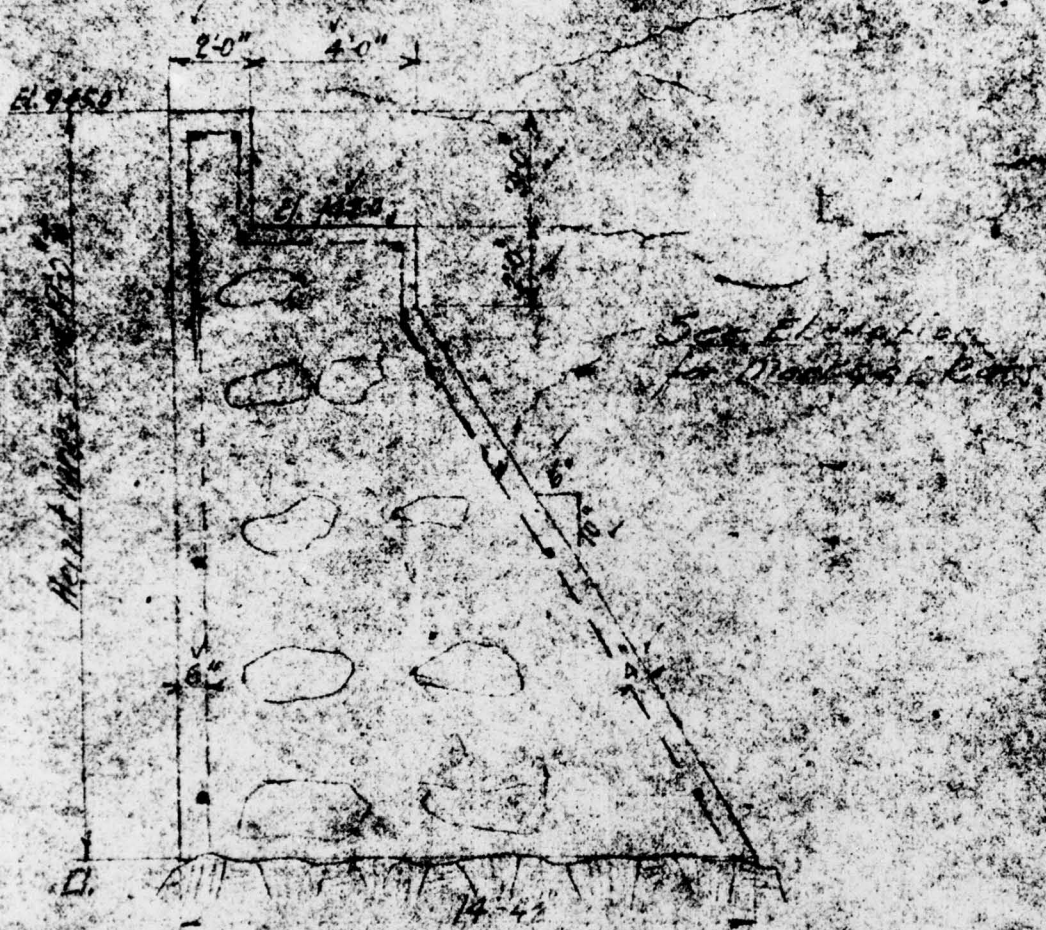
RET

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 4-5-40

SECTION DD

7

FS-38	2	25'-0"
FS-39	6	23'-0"
FS-40	8.0	20'-0"



SECTION EE

ATLANTIC UTILITIES CORPORATION
 HYDRO-ELECTRIC DEVELOPMENT ON
 MONGAUP RIVER SULLIVAN CO. N.Y.
 AT MONGAUP FALLS

DAM RETAINING WALL SECTION

R.R. LIVINGSTON, ENGR.
 12 RECTOR ST.
 NEW YORK CITY

DRAWN BY	CHECKED BY	APPROVED BY	37434
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8